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ANNUAL REPORT
1943

ALLEGHENY FOREST EXPERIMENT STATION

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EXPERIMENT STATION

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

ALLEGHENY FOREST EXPERIMENT STATION

In cooperation with the University of Pennsylvania
622 Bankers Securities Building
Philadelphia 7, Pennsylvania

Hardy L. Shirley, Director

ANNUAL REPORT FOR 1943

The Allegheny Station is proud of its 1943 war record. Lumber has become a critical and strategic war material. To direct its use into the most important channels, war agencies need to keep currently informed on the quantity and kind being sawed and of steps necessary to increase production.

Last year for the first time in history all sawmills in the Northeast were canvassed to determine total lumber production. Monthly estimates of lumber produced, based on reports from sample mills of the region, were made throughout the year. Quarterly surveys of lumber on hand at the mills and of factors influencing lumber production were made. Special information on log and pulpwood prices, on dry kiln capacity, on food and clothing needs of timber workers was furnished to war agencies. The Station continued to install, service, and inspect fire danger meter stations and to train observers for posts scattered along the east coast from Long Island to Cape Charles, Virginia, that damaging forest fires might be held in check. The opportunities for augmenting tannin supplies through greater use of hemlock bark and through use of red spruce bark from pulpwood peeling operations were investigated. Studies were outlined for gaining new information on kok-saghyz culture in the Northeast.

Station workers provided invaluable information and technical help to the Timber Production War Project. They explored the possibilities that sample log scaling might reduce time spent by forest officers on timber sales. At the State Forester's request, they studied the efficiency of Maryland mine prop cutters as influenced by tree size and selective cutting. In addition, staff members served on three state and three county agricultural war boards, and have taken a very active part in postwar planning in forestry for the region as a whole and for seven of the individual states.

These and many minor tasks were accomplished efficiently, expeditiously, and in conformance with high technical standards. Major war jobs such as the census of lumber production and forest products and supplies surveys, which were started a year or more earlier, were so systematized that substantial savings in manpower and costs were possible. As a result of this and other economies during the year, the Station was able to release one man for military service, raising the total to fourteen, and eleven additional technical and clerical workers for other war jobs, while taking on only two new workers.

So much for war work; it is necessary and it is being well done. High class performance is no more than the public has a right to expect from a permanent staff of highly-trained technical workers. But technical workers must not be content merely to handle assignments made by outside war agencies. They must through creative thought devise new war uses for technical findings, new ways to increase efficiency of manpower and machines, new facts and new analyses of old facts to guide postwar development. This we have also done. It is largely the results of this extra effort that we feature in this annual report.

SPRUCE-FIR PULPWOOD YIELDS CAN BE DOUBLED

The pulp and paper business in the Northeast has been a sick industry for a long while. In New York State, where the situation is most acute, pulp production declined from 771,000 tons in 1925 to 461,000 in 1939. The decline in production and the closing of many mills in New York State is attributed by the State Department of Commerce directly to the scarcity of pulpwood and the high cost of imported wood. Employment declined from 18,600 in 1925 to 16,700 in 1939. A large number of mills were forced to close. Mill capacity declined from 4,267,000 tons in 1923 to 2,689,000 in 1940.

Vermont is practically out of the pulp and paper business and New Hampshire mills are in a precarious situation. One company with the largest mills in the Northeast has only an eight years' supply ahead. The mills in Maine have a more secure backlog of material but they too are faced with declining forest productivity.

Research has shown that by merely changing the cutting cycle from clear cutting at 55 years to partial cutting at 30 or 20 years, pulpwood production on the land can be practically doubled. This is because balsam fir, which becomes diseased and decays at an early age, is mostly wasted at present but could be salvaged if the cutting cycle were reduced. This allows no advantage for increased productivity of growing stock that would be left on the ground as a result of the shorter cutting cycle. The figures, therefore, are very conservative.

Reducing the cutting cycle to 30 or 20 years has the further advantage of largely eliminating the overmature balsam fir which appears to nurse periodic outbreaks of devastating spruce budworm attacks. The danger from this cause alone may outweigh the few inconveniences and increased costs which might be involved during the first cutting cycle.

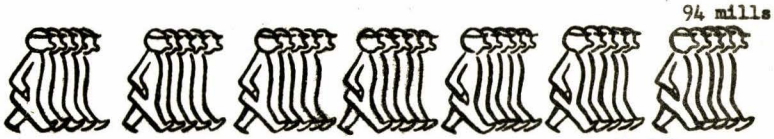
There is little reason to believe that the recommendations could not be put into practice immediately with very little, if any, increase in cost to many companies. Certainly, what increase in cost would be involved to reduce the cutting cycle from 55 to 30 years would be small compared with the heavy cost of importing pulpwood that New York mills must pay. This, of course, is only a small portion of the findings contained in a thick bulletin entitled, "Yields and Improved Cutting Practices in the Spruce-Fir Forests of the Northeast", which will soon be ready for printing. The story is shown pictorially on the following page.

Pulp And Paper Making Is Big Business. It Ranks High Among Northeast Industries

Operating mills total 94

94 mills

Workers employed total 35,000



35,000 workers

Annual payrolls total 40 million dollars

40 million dollars

Annual value of products total 250 million dollars

250 million dollars

Pulp mills harvest products from 15 million acres

15,000,000 acres

Bad Forest Practice Is Starving The Industry. Within 2 Decades 35 Mills Closed

The mechanical-sulphite mill capacity is 3,436,000 cords

3,435,000 cords

but yearly supply is reduced to 2,444,000 cords

2,444,000 cords

of which Northeastern forests provide 1,550,000 cords

1,550,000 cords

and we get from Canada 906,000 cords

906,000 cords

Simple Forestry Measures Can Sustain The Industry

Today's clear cutting at 55-year cycles permits the mills to harvest growth of only 1,435,000 cords; rot in the woods takes 2,092,000 cords

By partial cutting every 30 years, current requirements would be ensured by a growth of 2,827,000 cords

Partial cuts at 20-year intervals could provide a margin for future expansion. 87% of the total growth would be used, or 3,096,000 cords

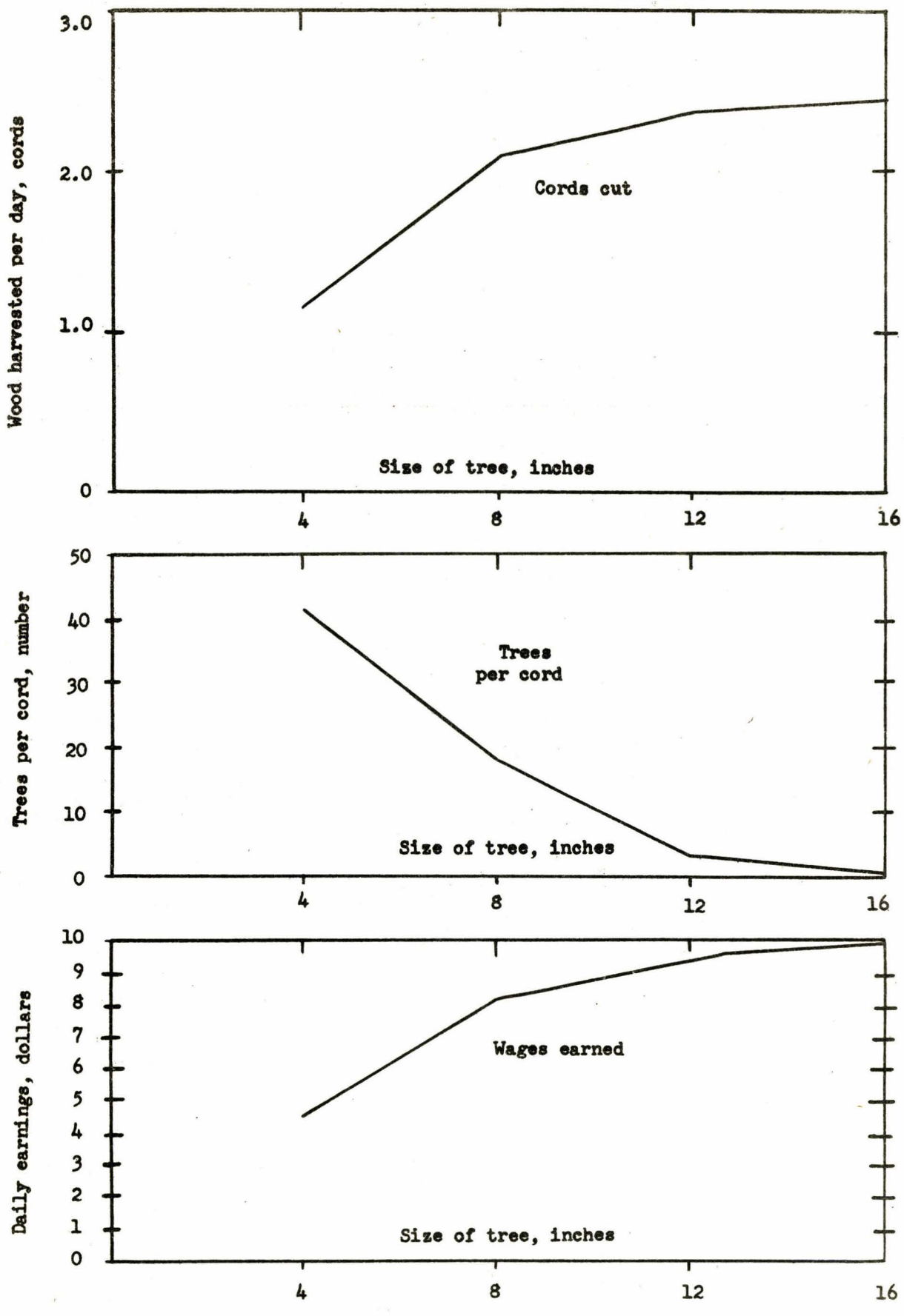
DON'T SEND SMALL TREES TO WAR

Recent studies by the Allegheny Forest Experiment Station pile up additional evidence against cutting small-sized trees. White pine lumber production has always been associated with clear cutting or "stripping". The operators or owners have been "penny wise and pound foolish" in their effort to turn every tree into lumber.

Previous studies showed that cutting and skidding 6, 8, and 12-inch pine trees required 10, 8, and 5.5 man-hours respectively per thousand board feet. Truck hauling showed the same trend, but the greatest waste is in milling these baby trees. To saw one thousand board feet of timber from 6, 10, and 12-inch trees required 9, 4, and 3 man-hours respectively. In pulpwood production in New England where everything that will make a bolt is usually taken, it was shown that to fall, limb, and peel a cord of pulpwood from 4, 8, and 12-inch trees required 16.6, 7, and 6 man-hours respectively.

Recent logging studies on the Allegheny Plateau of Pennsylvania show that where the average tree cut for lumber is 17 inches in diameter it takes 14 man-hours to cut a thousand board feet; whereas only 12½ man-hours are required where the average tree is 21 inches in diameter. In any operation where the material is sold by the cord, thousand board feet, or ton, it is more economical to use few large trees than many small ones to make up the unit.

More recent studies of chemical wood cutting add to the confirmatory data. As shown in the charts on the opposite page, the chopper of chemical wood doing piece work can cut per day only a little over 1 cord from 4-inch trees, but 2.4 cords from 12-inch trees. He has to cut forty-two 4-inch trees but only three or four 12-inch trees to make a cord, and his earnings consequently are doubled if he cuts only 16-inch trees. Obviously he would never cut trees of only one size, but it is evident that small trees are not a paying proposition. If left in the forest to grow, they can earn an attractive profit for the landowner. If cut, they waste valuable man-hours, space in trucks, and the yield is low and of little value.

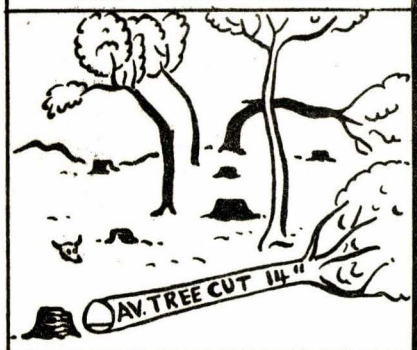
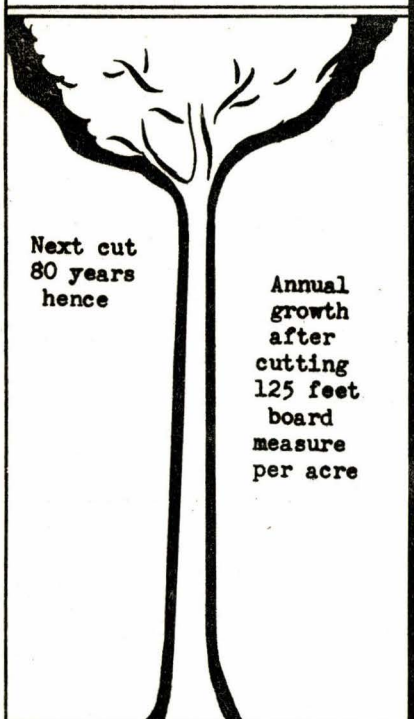
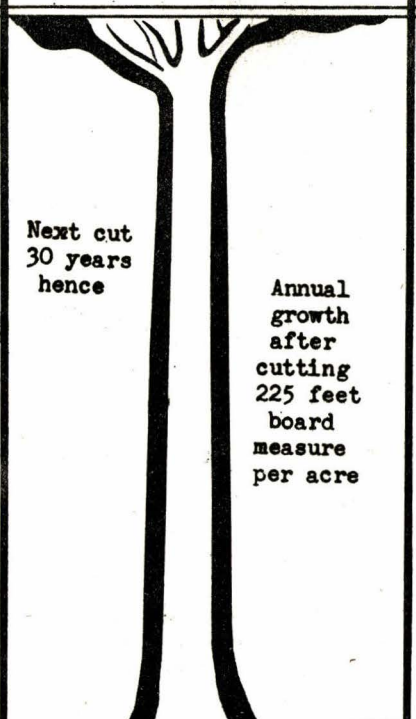
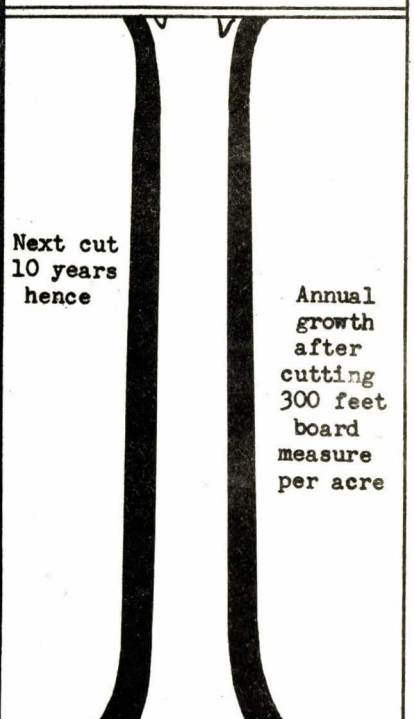

Wood harvested per day, cords
3.0
2.0
1.0
0
Cords cut
Size of tree, inches
4
8
12
16
Trees per cord, number
50
40
30
20
10
0
Trees per cord
Size of tree, inches
4
8
12
16
Daily earnings, dollars
10
9
8
7
6
5
4
3
2
1
0
Wages earned
Size of tree, inches
4
8
12
16

LABOR OUTPUT INCREASED BY SELECTIVE CUTTING

Yes! Present timber cutting practices do waste manpower today, restrict log production for war, and curtail future timber supplies. The diagrams based on studies made of the time required to fell, limb, buck, and skid trees of various sizes in a stand averaged 8,000 board feet per acre, and on the growth that may be expected on residual stands during the first 40 years after cutting bear this out.

But: This is not the whole story. First, bad cutting practices of former years have so depleted most Allegheny hardwood forests that they no longer average 8,000 board feet per acre. Second, transportation, log procurement, and other costs are sometimes increased during the first cycle of selective cutting.

Still: The labor saving available by applying selective cutting today, and the timber growth it makes possible for tomorrow are urgent reasons to overcome its minor drawbacks.

PRESENT COMMON PRACTICE	POSSIBLE PRACTICE NOW	POSSIBLE PRACTICE IN FUTURE
		
All trees down to 10" diameter cut. Ties, posts, and cordwood taken from remainder.	Cut most trees 14" and larger. Leave 1,000 feet board measure per acre as growing stock.	
17.7 man-hours per thousand board feet.	14.1 man-hours per thousand board feet.	12.5 man-hours per thousand board feet.
		
Man-hours wasted as compared to possible practice, 3.6 per thousand board feet	Man-hours saved, 3.6 per thousand board feet	Possible future man-hours saved, 5.2 per thousand board feet

Pennsylvania cut 348 million feet of logs in 1942, wasting 157,000 man-hours, or some 523 woodsmen for a year, - - - who could have produced, by using heavy selection, another 88 million feet or almost 40% more for war use. And there would be a fair stand reserved for future growth, - - - and by this method, the 523 woodsmen could have produced another 150 million feet if Pennsylvania forests were the kind of stands they should be.

GRADE HARDWOOD LOGS TO SAVE TIME AND MAKE MORE MONEY

Lumber buyers pay premium prices for long, wide, thick, clear boards. These prices are often three or four times those paid for short, thin, narrow, knotty lumber. Clear lumber saves time and waste in wood-using industries and is well worth the premium it commands. High quality lumber can be sawed only from long, large, clear, straight logs. Such logs take a long while to grow in the woods and once they have been grown must be properly cut if the owner, the mill man, and the lumber buyer are to profit most from nature's effort.

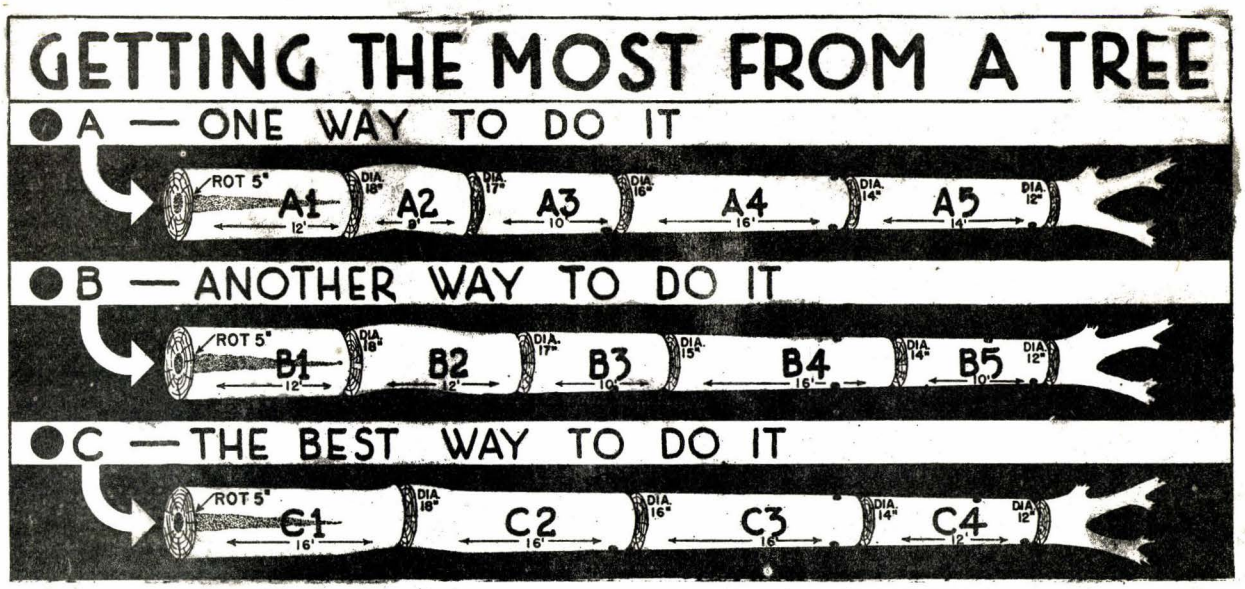
Despite the fact that select logs may be worth three to five times as much as No. 3 logs, the average timber buyer purchases standing trees on a lump sum basis, or logs on a log scale basis, with no differential based on grade. True, he may attempt to take grade into consideration in estimating how much he will pay for standing timber, but he does this merely on an overall basis, with no attempt at accurate application. He may do the same on a batch of logs but pays for all of them at the same rate per thousand.

There is a right way and several wrong ways to buck each tree into logs. Some are illustrated at the top of the following page. Methods A and B, all too common in woods practice today, waste everyone's time -- the timber cutters, the skidders, the log haulers, the sawyers, and the lumber handlers. And they produce less high grade lumber. Method C, by reducing the number of logs, saves 16% in logging time and yields several dollars additional in lumber values. Log grading rules are relatively simple to apply in the woods at the time the tree is being sized-up for bucking into logs. Grades are dependent mainly upon length, diameter, and amount of clear surface on three visible faces, together with crook, sweep, and rot. A few minutes study in the woods makes possible marking off a tree into proper lengths so as to yield the highest possible value.

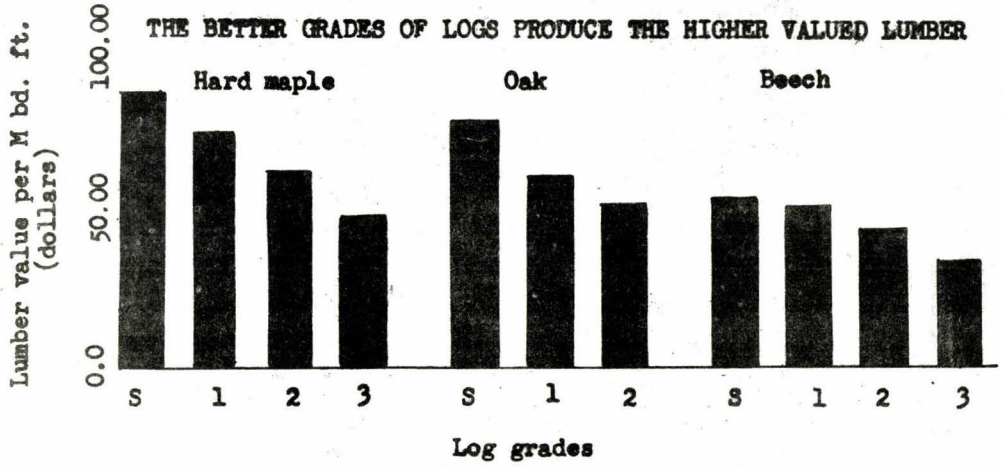
At the Otsego Forest Products Cooperative Association of Cooperstown, New York, where logs have been purchased by grade for several years, the Station last year conducted a study of lumber yield by log grades. The figures shown in the chart at the bottom of the next page are based on returns from 500 hard maple, oak, and beech logs. Select hard maple logs yielded 60% No. 1 common or better lumber and the entire output was worth $80.07 per thousand board feet under current OPA ceiling prices. Grade No. 3 logs, on the other hand, yielded only 17% No. 1 common or better lumber, which was worth only $42.00 per thousand board feet.

In these days of shortages in woods and mill labor, and acute need for good lumber to fabricate war materials and pack them for shipping, any method that will save manpower and produce a better product should be adopted with avidity. Sawmill and timber operators will find it very much to their advantage to place simple log grading rules in the hands of their timber cutters and to train these men in their use. The universal adoption of hardwood log grading will result in lower logging costs, higher production per man-day, and increased lumber values amounting to several hundred thousand dollars each year for the eastern hardwood region.

GETTING THE MOST FROM A TREE



		Log 1	Log 2	Log 3	Log 4	Log 5	Total footage	Lumber value per M Maple	Oak	Beech
A	Log grade	Select	#2	#2	#1	#2				
	Gross scale	147	84	90	100	56				
	Net scale	137	72	90	100	56	455	73.78	68.00	53.87
B	Log grade	Select	#1	#2	#2	#2				
	Gross scale	147	127	75	100	40				
	Net scale	137	115	75	100	40	467	73.88	68.01	53.96
C	Log grade	Select	#1	#1	#2	Saves				
	Gross scale	196	144	100	48	16% of				
	Net scale	180	138	100	48	labor	466	78.22	71.74	56.42
	Excess value of method C over method A							4.44	3.74	2.55
	Excess value of method C over method B							4.34	3.75	2.46



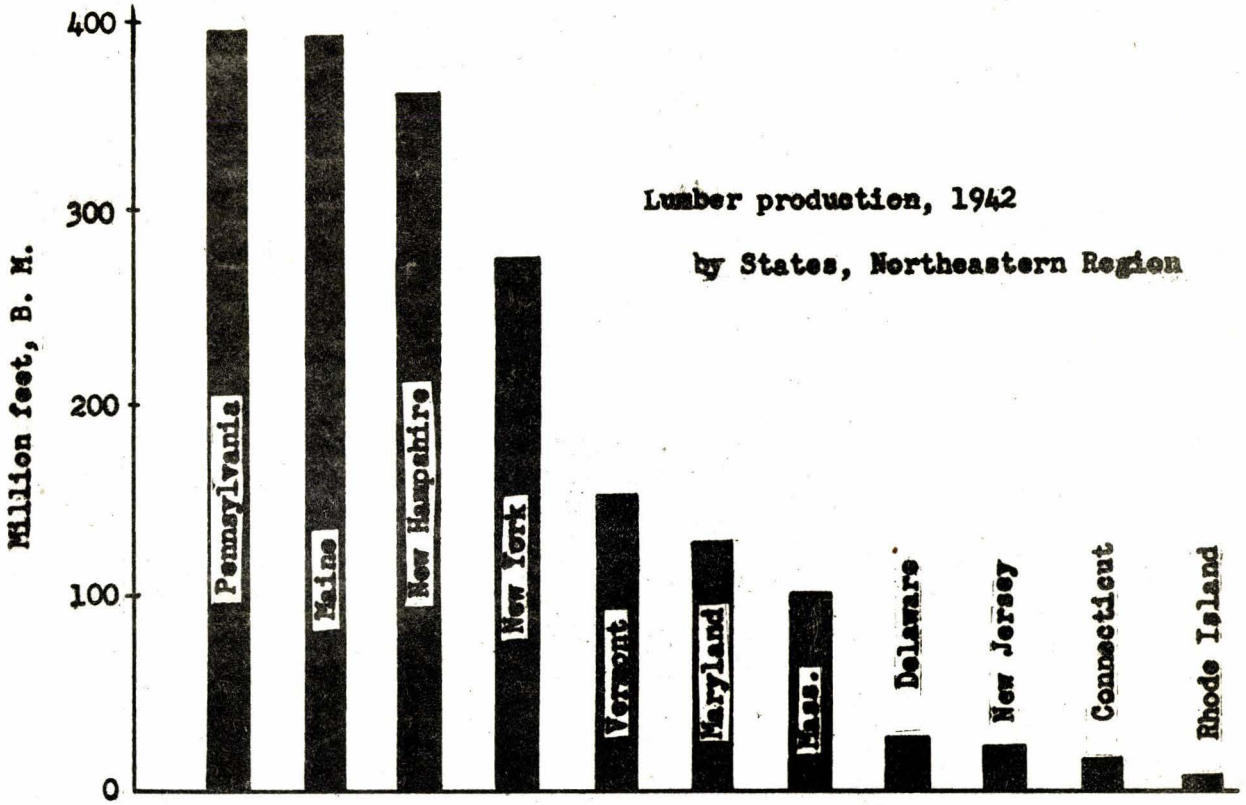
NORTHEAST STILL PRODUCING

ALMOST TWO BILLION BOARD FEET OF LUMBER ANNUALLY

Early in 1943 the Forest Service in cooperation with the Bureau of the Census and the War Production Board made a complete canvass of sawmills in the Northeast. This was to determine total lumber production for 1942 so that it might be compared with consumption for the year and needs for 1943. The Allegheny Forest Experiment Station was charged with this job in New England, New York, Pennsylvania, New Jersey, Delaware, and Maryland.

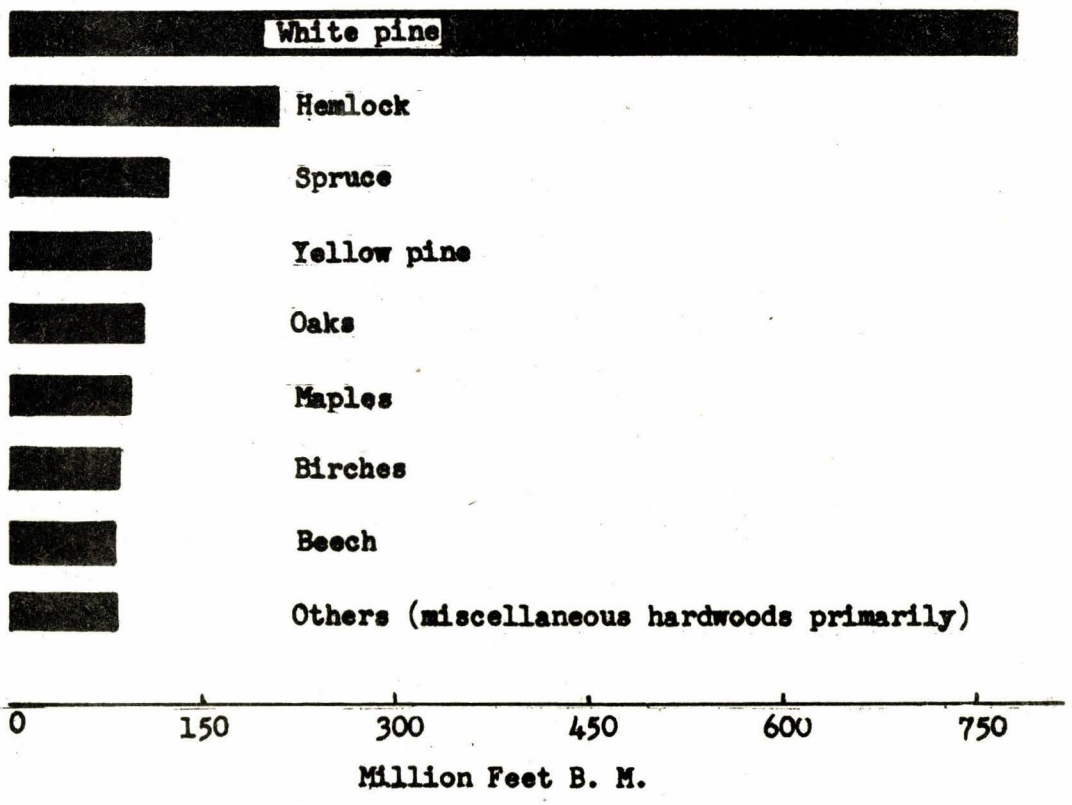
The completed census showed a total production of 1,894,446,000 feet board measure for the region, or about 11% more than in 1941. Part of this increase, however, was due to an increase in mills reported by the field canvass -- mills that had produced in 1941 but had not been reported. However, increased production was not entirely due to this. Sawmill men, in the face of war restrictions of all kinds, actually produced more lumber. The number of mills producing 50,000 board feet per year or more reported in 1941 was 2,845. In 1942 it was 3,363, an increase of 518 mills. As almost all of these were in Class 0 or 1 (under 500,000 board feet per year), the increase due to their production could not exceed 120 million board feet, or 42% of the total increase.

A census will again be taken early in 1944 to determine 1943 production, but it will be done by means of sampling a large portion of the mill population, rather than by making a 100% canvass. Production for 1942, in decreasing order by states and species, is shown on the opposite page.



Lumber production, 1942

by States, Northeastern Region



KEEPING INFORMED ON CURRENT LUMBER PRODUCTION

Since October 1942 the Station has kept its finger on the pulse of sawmill production in the eleven northeastern states (Maryland to Maine) for the War Production Board. This is done by means of monthly contacts of sample sawmills throughout the region. Reports are obtained by mail or personal visit from about 450 of the 4,704 sawmills, care being taken to sample the various production size classes. Twenty-three percent of the total lumber production is sampled each month. Statistical analyses indicate an error of estimate within 4% plus or minus for the eleven states as a whole, and about 15% for any one state, with possible exceptions in states having few mills and low lumber production. The latter have little effect, however, on the regional estimate as a whole.

The lumber production estimate, month by month, for the northeastern region for the first eleven months of 1943 is shown in Figure 1. The cumulative production for eleven months (Figure 2) totals 1,667 million feet board measure, which is 226 million feet, or 12% less than last year's total cut. December 1943 figures just received (after Figure 1 was printed) show an increase over November of 4.7%. This adds 129 million feet to the eleven months' total, making a total gross cut for 1943 of 1,796 million feet board measure, or 5.2% less than the total production for 1942. Figure 2 shows the 1943 cut as it accumulated. This is based upon the assumption that the error in sampling is compensating.

Labor shortage remains the most troublesome item among the factors affecting production. Equipment and parts caused little trouble in 1942 but during 1943 rose from 1% to 10% of the cause of lowered production. A year ago sawmills were 30% short of full crews. Now they are about 20% short but the monthly turnover of labor has increased from 10% to 20% or 25%. A production of only 5% less than that of 1942 is a reflection of the patriotism and "stick-it-out" ability of sawmill men in the face of innumerable difficulties. The Experiment Station through its monthly survey contacts and the Forest Service's recently organized Timber Production War Project are doing everything possible to help the industry in the larger producing states.

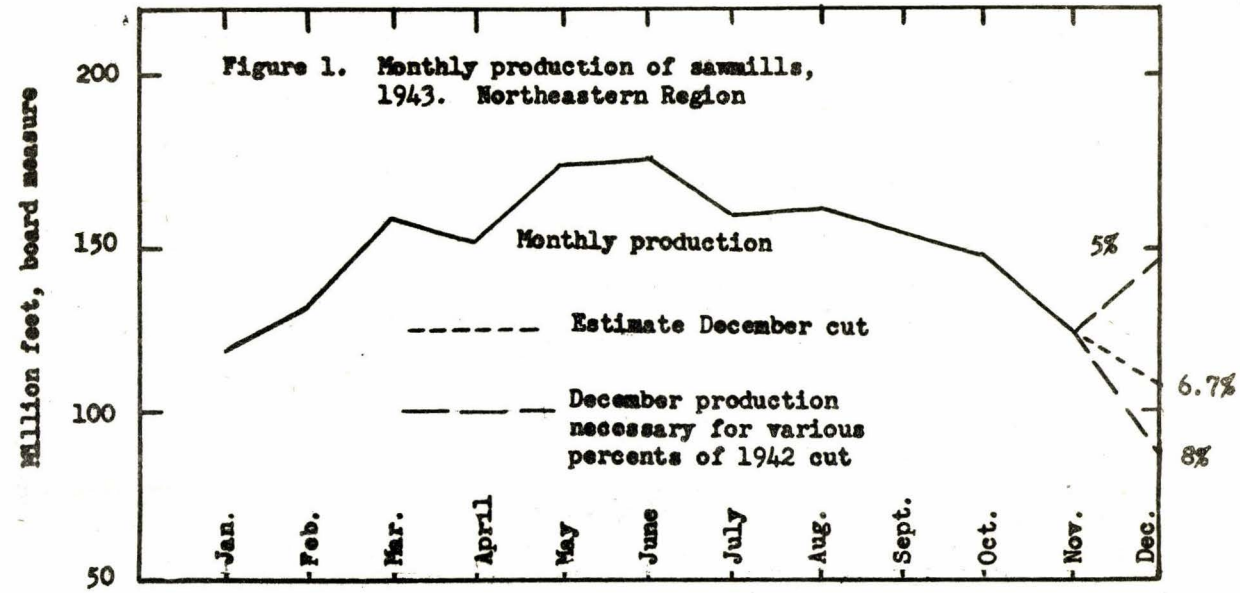


Figure 1. Monthly production of sawmills, 1943. Northeastern Region

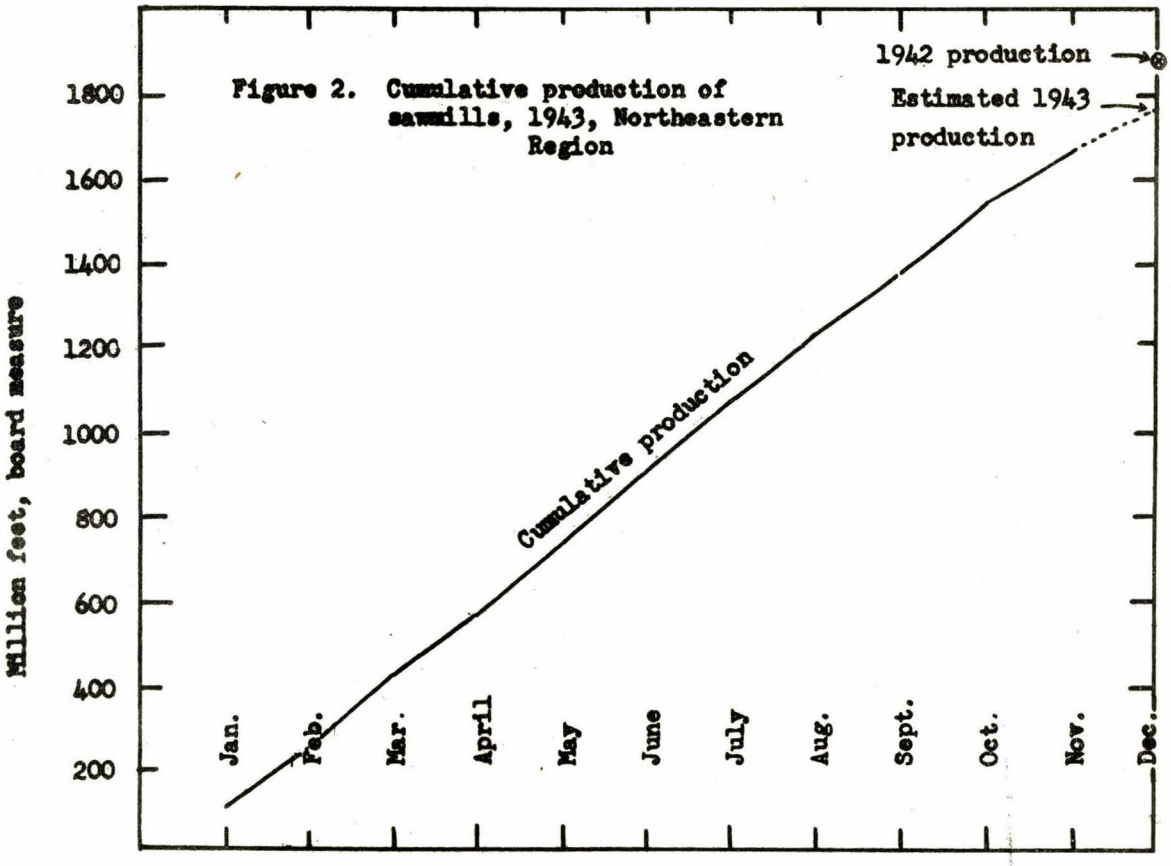


Figure 2. Cumulative production of sawmills, 1943, Northeastern Region

MEASURING FOREST FIRE DANGER

For many years a method of predicting each day the probability of forest fires starting has been sought. The Fire Danger Meter is the answer. It is based on wind velocity, fuel moisture content, season of year, and number of days since the last rain. When these items are fed into a slide rule "meter" the class of fire danger for the day comes out. A class 1 day is pretty fire-proof, but a class 5 day is extremely dangerous.

The first forest fire danger meter for the eastern United States was developed more than four years ago by the Appalachian Forest Experiment Station. However, it was not until we faced military hazards from forest fires and wartime dearth of experienced fire fighters that the fire danger rating system was given a crucial test. During the past two years the Allegheny Station helped to locate, establish, inspect, and service that portion of a complete network of fire danger stations set up at the Army's request that extends from Long Island to Cape Charles, Virginia. An analysis of the results from using the fire danger rating system reveals that full value can be realized only if the following measures are put into effect:

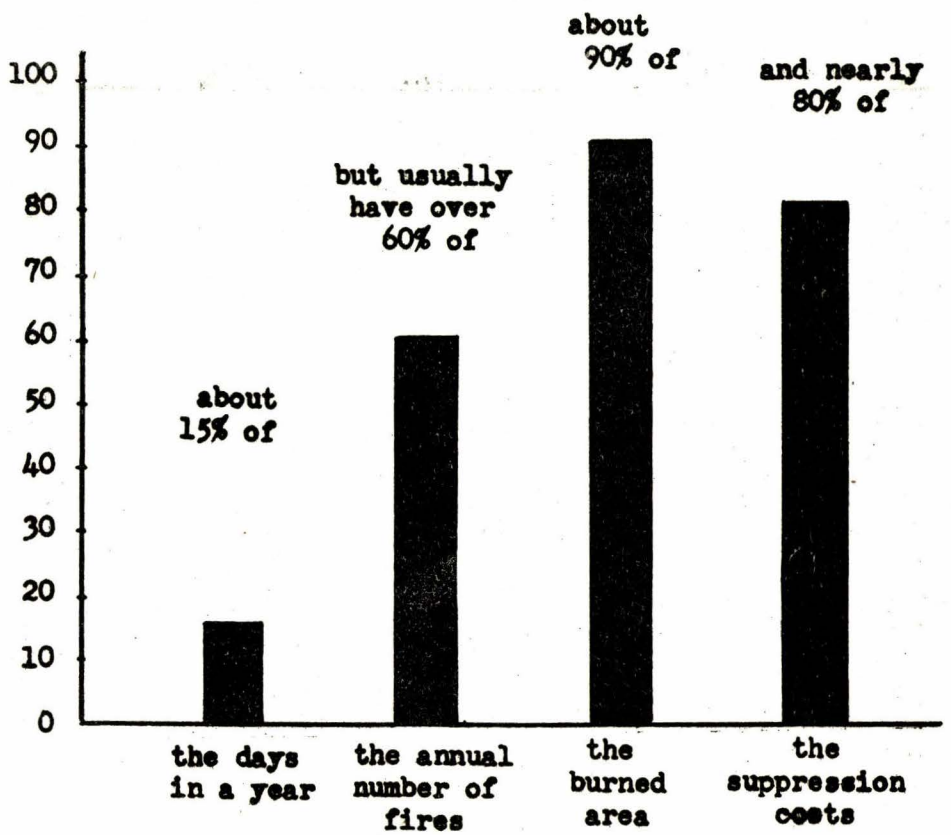
1. An adequate network of stations must be established in each state.

2. Complete fire organization plans must be developed based on the danger rating system, on the available organization and finances, and on the protection needs.

3. The danger ratings should be used in all work pertaining to fire, such as debris burning.

Investigations are planned to correct the fire danger meter for more accurate representation of local conditions under various types of forest and brush cover. On a class 2 day for a general locality, for example, fire danger on brush areas might be more accurately shown as class 3 or 4, and distribution of patrols assigned accordingly.

In South Jersey During the Fire Season
of March, April, and May, Class 3 to 5 Days Are



SEEKING TREES ABLE TO COMPETE WITH GRASS

Research can be as unpredictable as a courtesan, and in some respects it has the same allure. All too often it leads only to the expected or to complete disappointment, but the quest never loses the fillip of possible surprise. Unexpected leads to the solution of far larger problems will continue to be beaten out of the underbrush bordering the trail to more immediate objectives. The necessity of finding the answer to successful reforestation of abandoned farm land with the new hybrid poplars has uncovered such vistas of unexplored realms.

An experiment was started in 1940 to determine how much site preparation and care after planting was necessary to establish hybrid poplars on grass land. Poplars were planted directly in grass; in 12", 18", and 24" squares (scalps), and in 12", 18", and 24" wide furrows from which the grass was removed; and on areas from which the grass was completely removed. Each grass removal treatment was combined with each of the following three types of soil treatment:

1. Sod removed from the planting site, no additional soil treatment.

2. Sod removed from the planting site, soil spaded to a depth of eight inches.

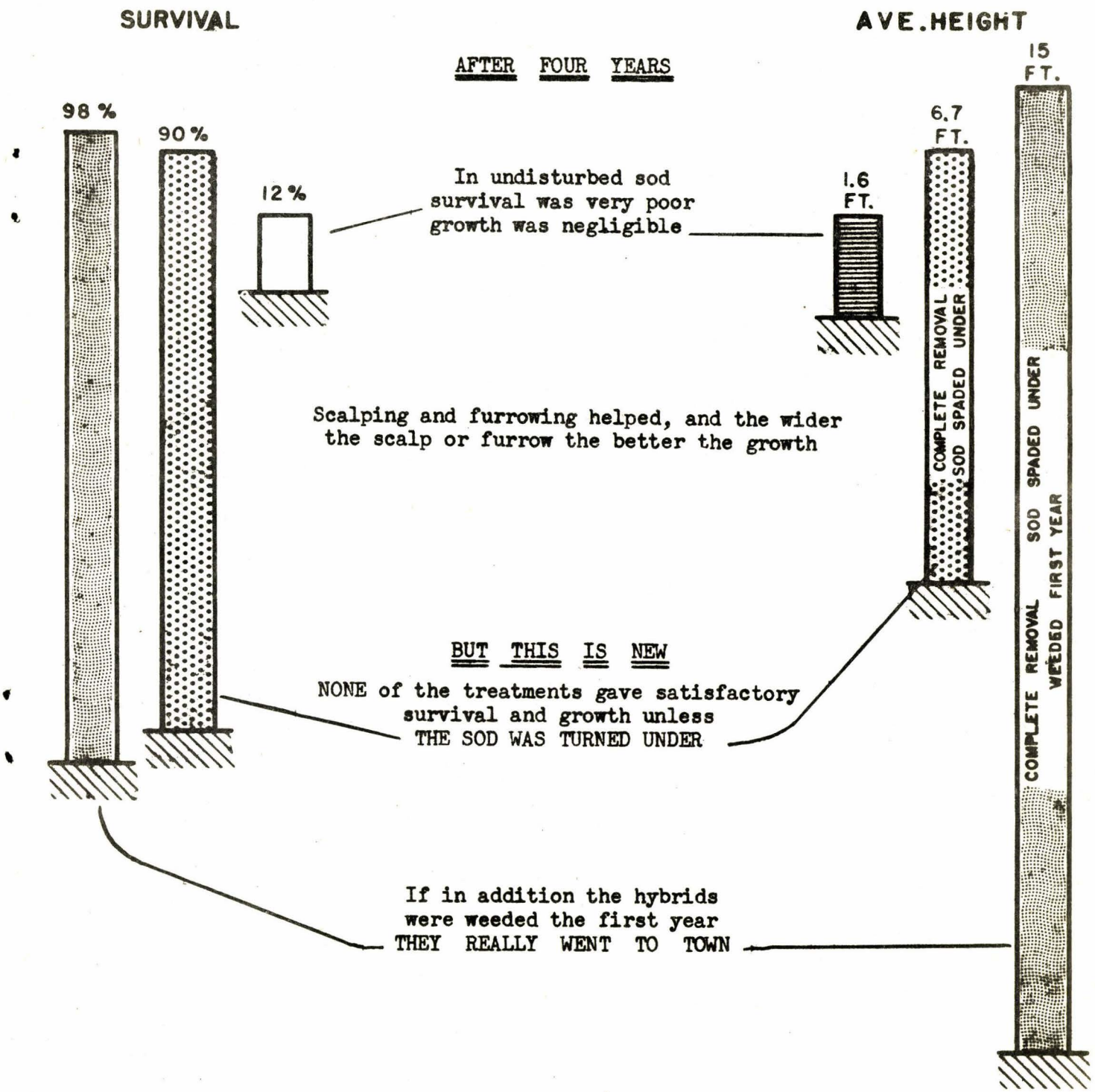
3. Sod turned into the ground to a depth of eight inches.

Half of each treatment plot was kept clear of weeds during the first growing season by hand hoeing and half was left unweeded.

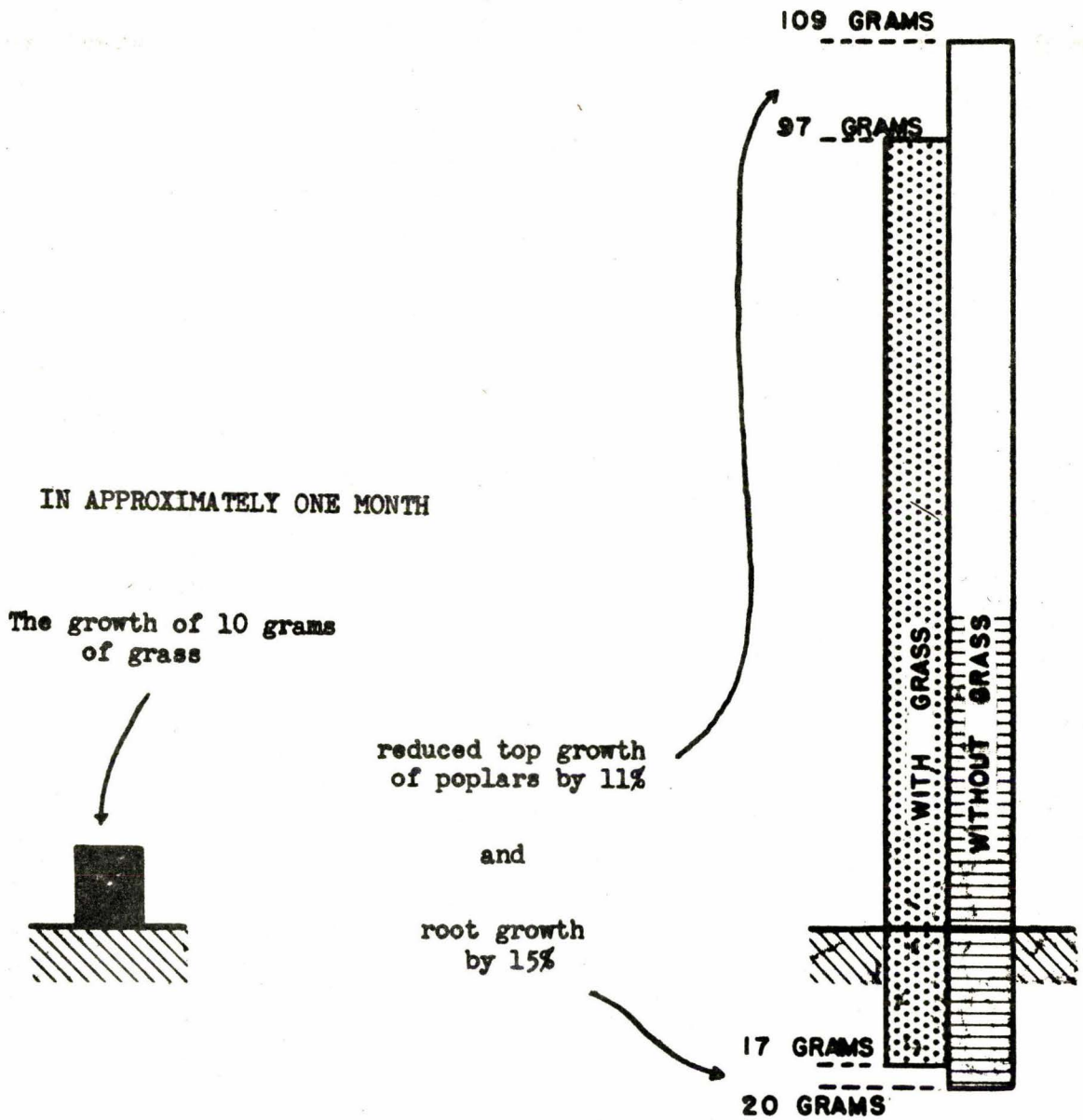
It should be noted that treatments 1 and 2 above are comparable to present planting methods (scalps or furrows) where the sod is turned aside and adds nothing to the fertility of the immediate planting site. Treatment 3 is comparable to plowing.

A prosaic experiment -- intended to solve a rather dull and simple problem -- how to establish poplars on grass land. But the results appear to have opened a new avenue of approach to the whole problem of successful reforestation, as well as a promising new field of practical endeavor in forest genetics.

YES, we did learn what to do, and what not to do, to establish hybrid poplar on grassland


SURVIVAL
AVE. HEIGHT
AFTER FOUR YEARS
98 %
90 %
12 %
In undisturbed sod survival was very poor growth was negligible
1.6 FT.
6.7 FT.
COMPLETE REMOVAL SOD SPADED UNDER
15 FT.
COMPLETE REMOVAL SOD SPADED UNDER WEEDED FIRST YEAR
Scalping and furrowing helped, and the wider the scalp or furrow the better the growth
BUT THIS IS NEW
NONE of the treatments gave satisfactory survival and growth unless THE SOD WAS TURNED UNDER
If in addition the hybrids were weeded the first year THEY REALLY WENT TO TOWN

HYBRID POPLARS GROWN IN IDENTICAL NUTRIENT SOLUTIONS
QUICKLY REVEAL THOSE SENSITIVE TO GRASS INHIBITION

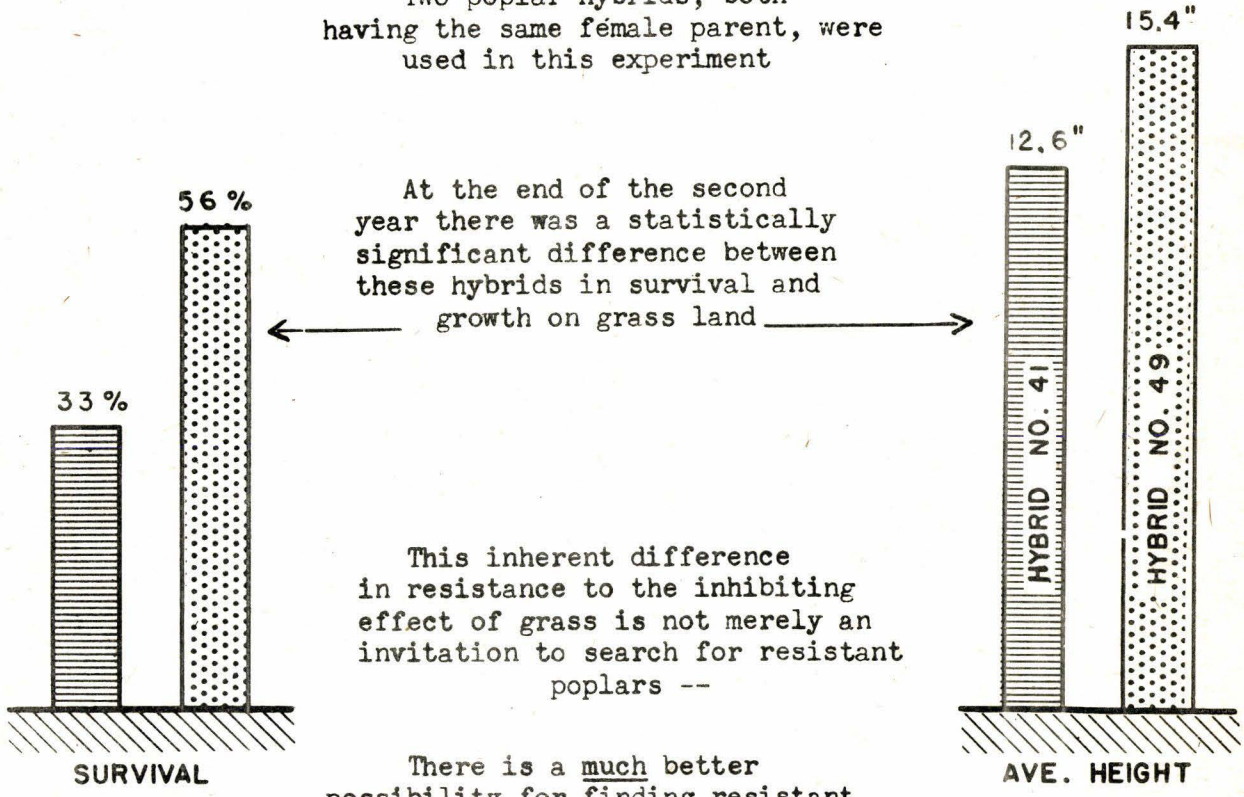


IF WE CAN CONTINUE THIS WORK -- AND WITH REASONABLE LUCK --

IT WON'T TAKE TOO LONG

AGAIN THE UNEXPECTED

Two poplar hybrids, both having the same female parent, were used in this experiment



At the end of the second year there was a statistically significant difference between these hybrids in survival and growth on grass land

This inherent difference in resistance to the inhibiting effect of grass is not merely an invitation to search for resistant poplars --

There is a <u>much</u> better possibility for finding resistant types of maples, ash, conifers; and of any species which invade abandoned fields and pastures

THINK WHAT GRASS RESISTANT TREES WOULD MEAN TO POSTWAR FOREST PLANTING

PROPERLY TIMED FERTILIZING HARDENS NURSERY STOCK

A new feeding schedule in which a heavy dosage of fertilizers is applied to forest nursery stock during the late fall or early spring, prior to outplanting, has been found to increase field survival during drought years by as much as 20%. This may mean a saving of $3.00 or more per acre in planting costs, for an outlay of 30 cents. For a planting program such as we carried in prewar years, savings might amount to some $300,000 annually. America faces a 32,000,000 acre forest planting program in postwar years and a saving of as much as $3.00 per acre would be real money indeed. But how is it done?

Seedlings allowed to grow a full season in highly-fertilized nursery beds attain large size but lack drought resistance. Resistance can be improved by restricting the amount of leaf-building nitrogen in the "diet" and maintaining the proper balance among nitrogen, phosphorous, and potassium. Resistance can be still further increased by applying heavy dosages of fertilizer during the dormancy period 1 to 5 months before lifting for outplanting.

Other species reacted similarly to loblolly pine but further work must be done to determine the best time, formula, and concentration in which to apply fertilizers to get the best results. Here is a valuable technique for greater success of postwar forest plantings. It should be promptly worked out so that it will be ready for use.

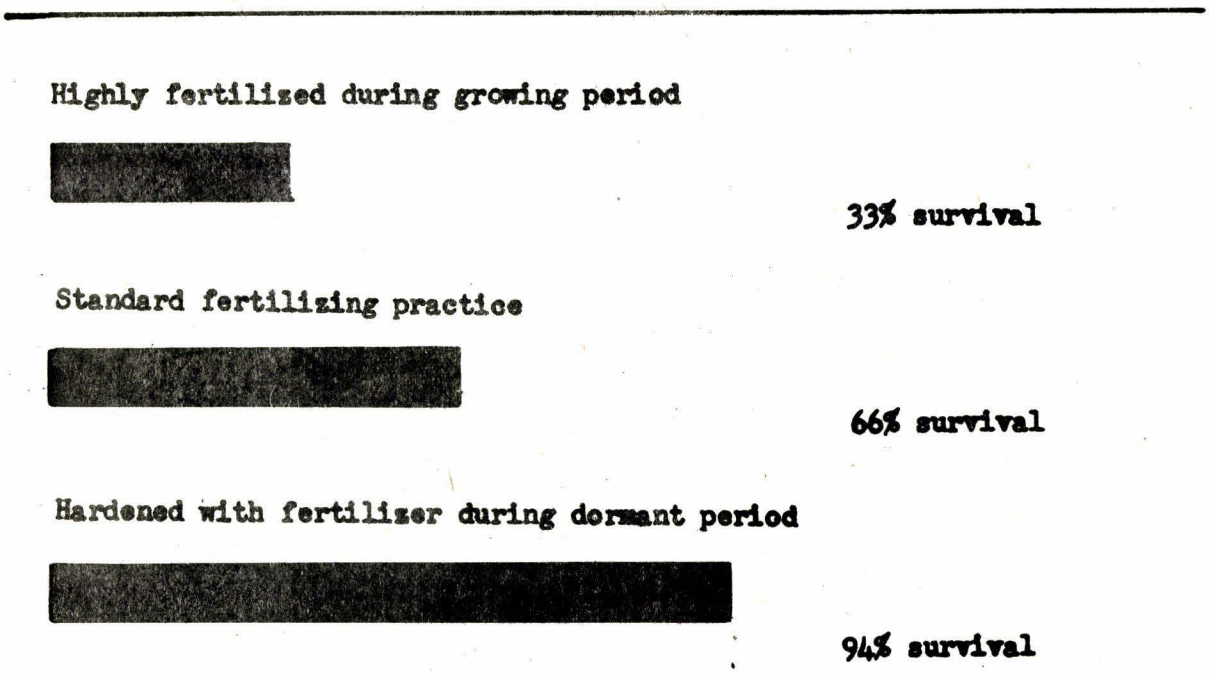


Figure 1. Field survival of loblolly pine during drought as effected by fertilizing schedule

HOW TO MOVE TREES IN MIDSUMMER

Sapling-sized trees 6 to 12 feet in height of both conifers and hardwoods can be successfully moved in midsummer. This can be done without the expensive and time-consuming process of root balling, provided other necessary precautions are taken. This fact was demonstrated at the Beltsville Forest Laboratory as a result of studies undertaken to improve the use of woody vegetation for camouflage purposes.

The urgencies of modern warfare do not permit of waiting for the most favorable season of the year to camouflage military installations. For example, an addition to a Martin aircraft factory was completed in midsummer of our first year of war. It was immediately camouflaged using, in addition to various artificial devices, spruce and arborvitae saplings. A few weeks later almost half the trees were dead.

But during the same August 9-year-old saplings of silver maple, white ash, red spruce, and arborvitae (180 of each species) were transplanted at the Beltsville Forest Laboratory, which is only a few miles distant from the aircraft factory, with negligible loss. Even after experiencing one of the driest seasons on record the following summer, survival remained high. The first and second seasons' losses by species for balled and bare root stock are shown in Figure 1.

Various growth regulators were applied to roots and to the soil surrounding the transplanted saplings in hopes that they might improve survival. All proved to be either harmful or ineffective. Red spruce was more easily injured by growth regulators than the other species. Silver maple was hard hit by drought and by maple borers the second year. Balling the roots was advantageous in all cases but it more than quadruples transplanting time and costs and therefore is to be avoided whenever possible.

The primary requisites for successful bare-root transplanting appear to be (1) vigilant protection of roots against drying; (2) proper planting, which involves packing the soil carefully about the roots and settling it with water; (3) heavy top pruning of hardwoods; and (4) supplemental watering during the first year if rain is inadequate to keep the soil moist.

Further test of these and other planting principles was made the following spring using scarlet oak, a difficult tree to move, as test material. The trees were transplanted in June of 1943 while in full leaf. Severe drought ultimately caused the death of most of the trees but survival at midseason brought out effectively the value of the technique recommended above. In addition, it was found that "quick feeding", applying fertilizers liberally during the dormant period before lifting, increased survival by 17%. This latter treatment can be applied at a cost of about 8 cents per tree, or only 5% of the total cost for stock of sapling size.

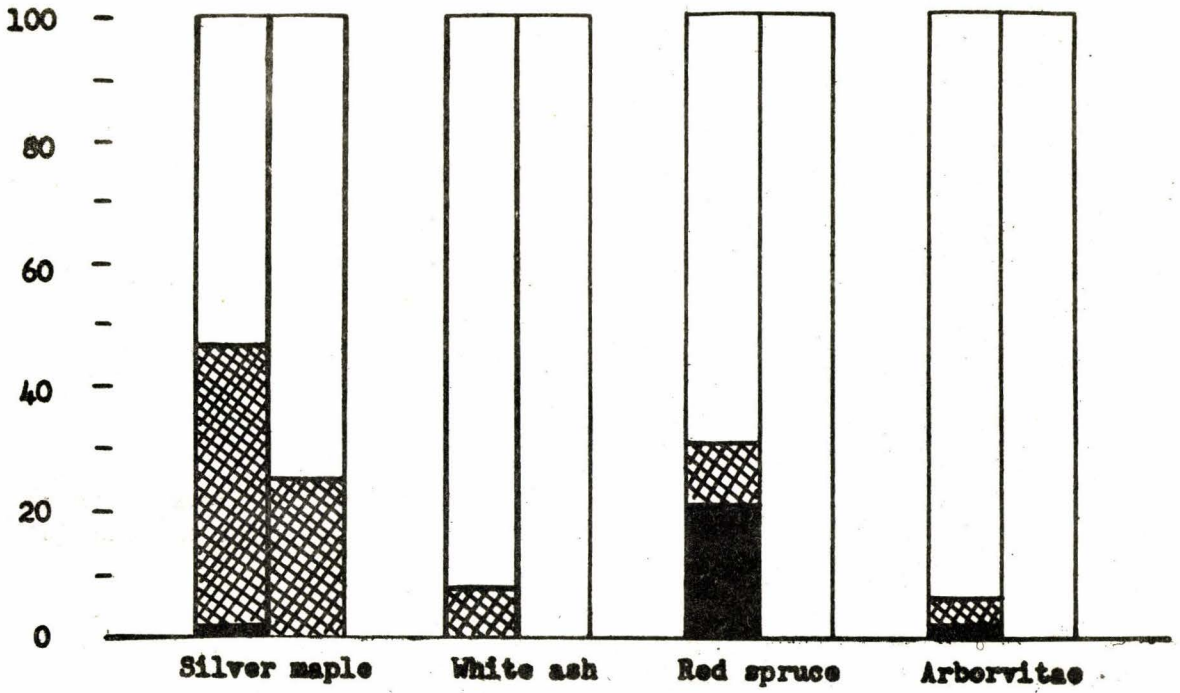


Figure 1. Behavior of 9-year-old saplings transplanted from nursery to field in Aug. 1942. Left bar in each pair bare-root stock; right bar, balled stock. Solid black, mortality Aug. 1942 to April 1943; cross-hatched, mortality April 1943 to Nov. 1943; white, survival.

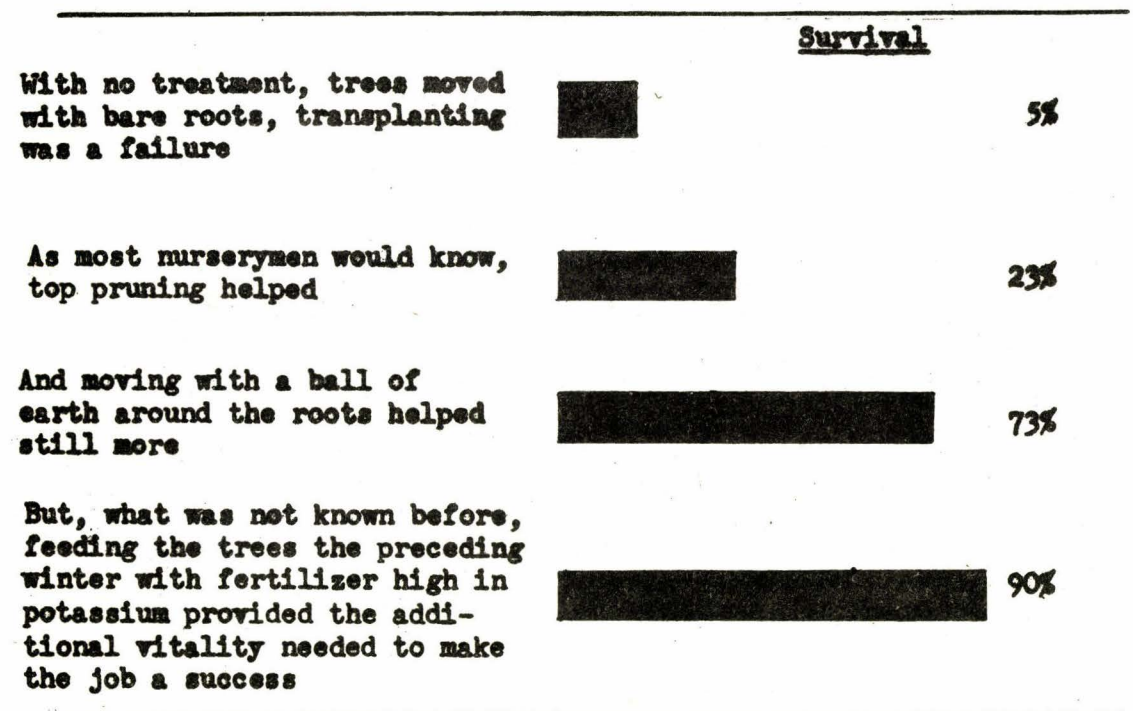

Survival
With no treatment, trees moved with bare roots, transplanting was a failure
5%
As most nurserymen would know, top pruning helped
23%
And moving with a ball of earth around the roots helped still more
73%
But, what was not known before, feeding the trees the preceding winter with fertilizer high in potassium provided the additional vitality needed to make the job a success
90%

Figure 2. Survival of scarlet oak saplings transplanted from nursery to field in mid-June of 1943 while in full leaf.

PROLONGING DORMANCY FOR LATE SPRING PLANTING

Dormancy of hardwood nursery stock can be prolonged one to four weeks by proper treatment with plant growth regulators. In this way the spring planting season, normally of 3 to 5 weeks duration, can be extended by 25% to 80%, correspondingly increasing acreage planted and effective use of trained planting crews. It also provides a means by which spring planting can be continued until the job planned is completed, even though an early break in spring weather might otherwise necessitate terminating the work.

The plant growth regulators, naphthalene acetic acid, naphthalene methylacetate, naphthalene acetamide, and mixtures of naphthalene compounds with or without indolebutyric acid, were applied by dipping tops in aqueous solutions, exposure of plants to vapors, and by spraying growth regulators on the stems and buds using lanolin or wax as carriers. Buds of white ash, if treated in the nursery, remained closed for a week longer than untreated plants and if treated in storage, for four weeks longer.

In hardwoods, the delay in top growth caused by treatment was only temporary and normal growth was soon resumed. In pines, on the other hand, dormancy was not prolonged and the initial surge of leader growth was not substantially reduced, but the area of new foliage was greatly curtailed, usually for the remainder of the season. Thus for some pines, top sprays of growth regulators succeeded in holding back growth of the stock for a full season. Treated ash seedlings irrespective of subsequent storage conditions survived much better than control seedlings did when planted in late spring.

But prolonging dormancy by growth regulators may be compared to most newly invented mechanical devices in that both are full of "bugs". Some of these "bugs" are: The margin between the concentration that prolongs dormancy and the one that injures is narrow and seems to vary with the condition of the stock. Treated pines of certain species develop crooked leaders that harden into crooked stems. Treatments sometimes induce root initiation on stems of white ash. The effects produced vary with the carrier used for the growth substance.

When the foregoing details have been adequately worked out, there is every reason to expect that the lifting and planting seasons may be extended, that a simple chemical treatment may substitute for expensive refrigeration in storage of hardwood stock, and that certain conifers may be held for an additional year in the nursery without over-development of tops.

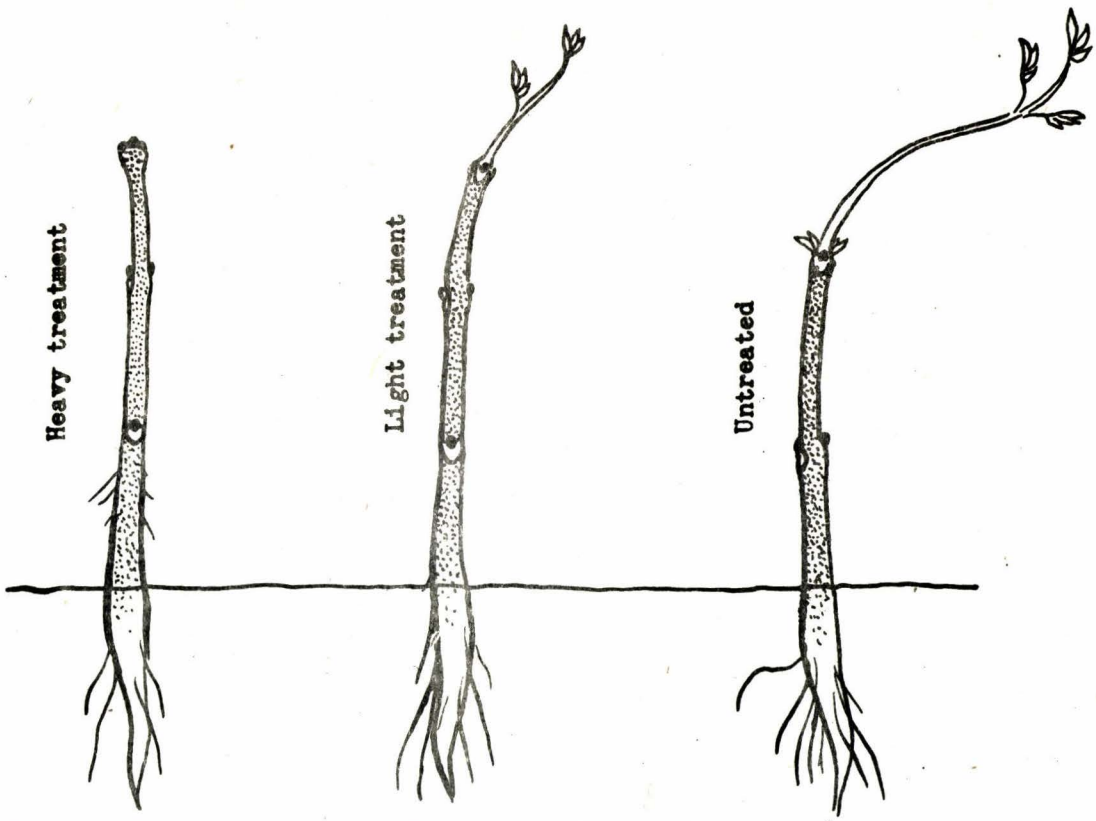


Figure 1. White ash lifted in April and treated with naphthalene methylacetate remained dormant in common storage until June 4.

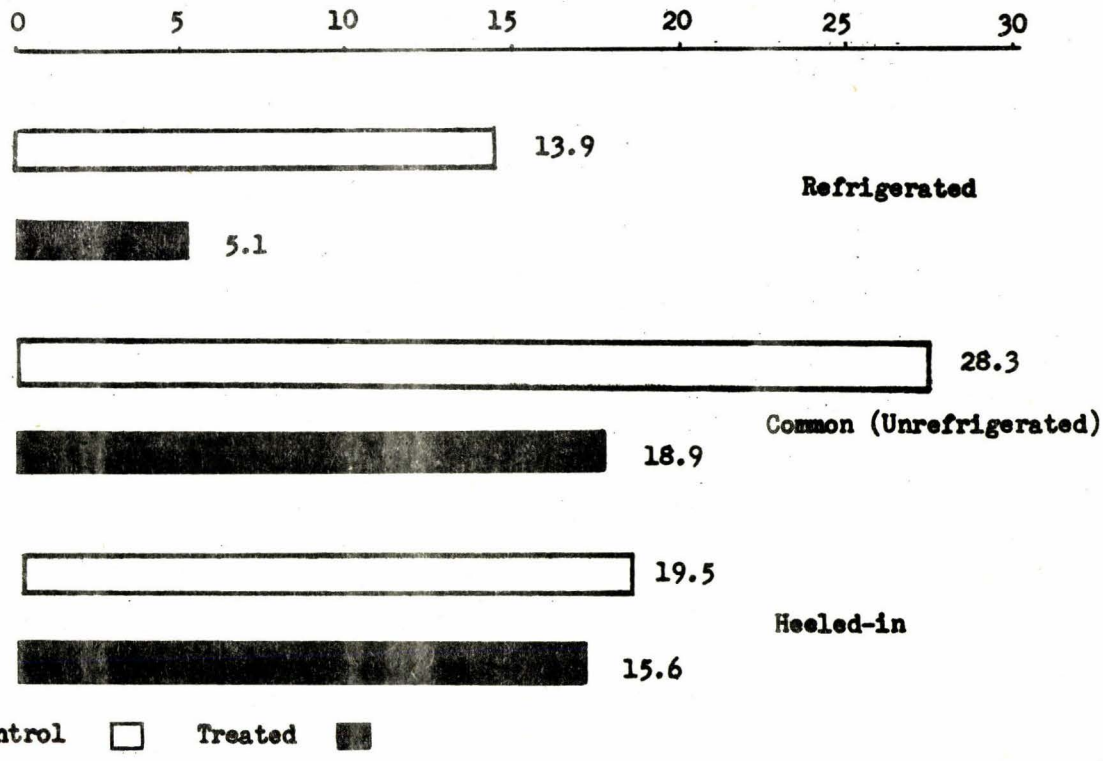


Figure 2. Field mortality of white ash as affected by treatments to prolong dormancy.

QUICK HEALING OF TREE WOUNDS

Tree wounds will heal twice as fast if treated with proper wound dressing and if the tree receives the right fertilizers. This finding, the outgrowth of studies on how to preserve trees valuable for camouflage that had been injured during construction, is also of significance to arborists and shade tree specialists.

Shellac, a standard wound dressing, proved to be but little better than no treatment in preventing dieback from the edges of wounds and surface drying and cracking that opened an avenue for fungus spores (Figure 1). Asphaltum prevented drying and cracking but did not adhere well at the edges. It also had a tendency to crack.

The best dressing, however, was lanolin. This had all the advantage of asphaltum and excellent adherence. Additions of rosin or pine gum to lanolin were useful in regulating viscosity at time of application and in forming a hard surface over the dressing after it had set a few days. Lanolin-treated oak wounds not only healed faster from the margins but in many cases actually healed to some extent from the wound surface as a result of proliferation of ray tissue. Oak wounds properly treated with lanolin closed 56% faster than untreated wounds.

Untreated pitch pine wounds were very slow to heal compared with lanolin dressed wounds. Wounds in black tupelo, scarlet oak, red maple, and beech all reacted favorably to lanolin treatments. Growth substances added to the lanolin dressing sometimes have slightly increased the rate of healing, and sometimes have caused injury, due at least in part to use of inappropriate concentrations. Further investigation of concentration ranges is required.

Quickest healing occurred where fertilizers were applied about the base of the tree in addition to dressing the wounds (Figure 2). Although many fertilizer treatments were tried, those containing a high level of nitrogen and moderate levels of phosphate and potash proved most useful for oak wound healing. Pitch pine wounds healed fastest when all three nutrient elements were high. Further refinement of both dressing compounds and fertilizing technique can be expected to improve still further the rate of tree wound healing.

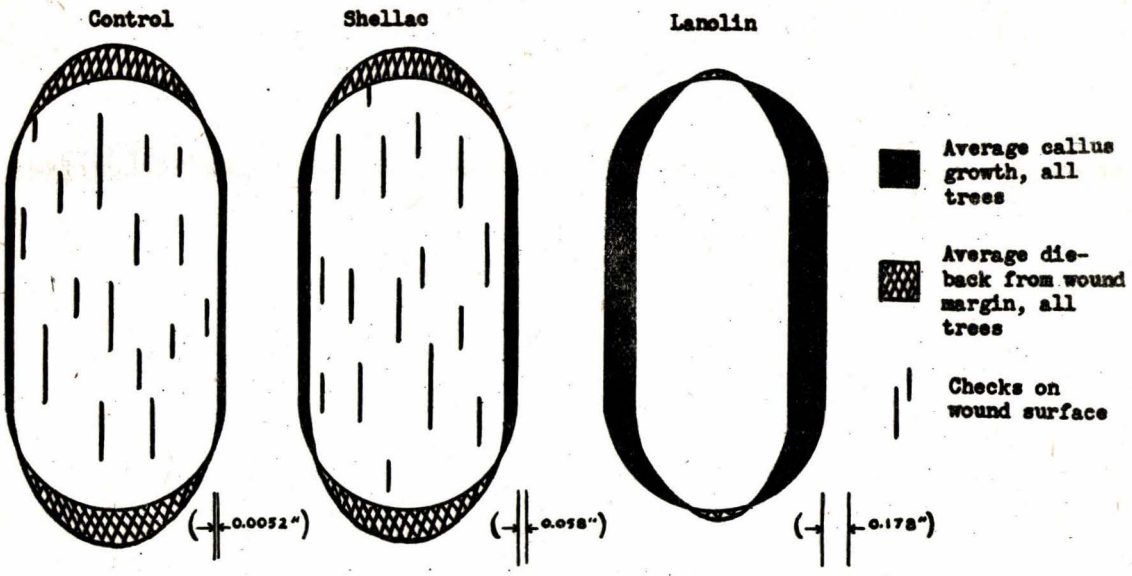


Figure 1. Healing during the first season of scarlet oak wounds given no treatment, a shellac coating, and a lanolin coating.

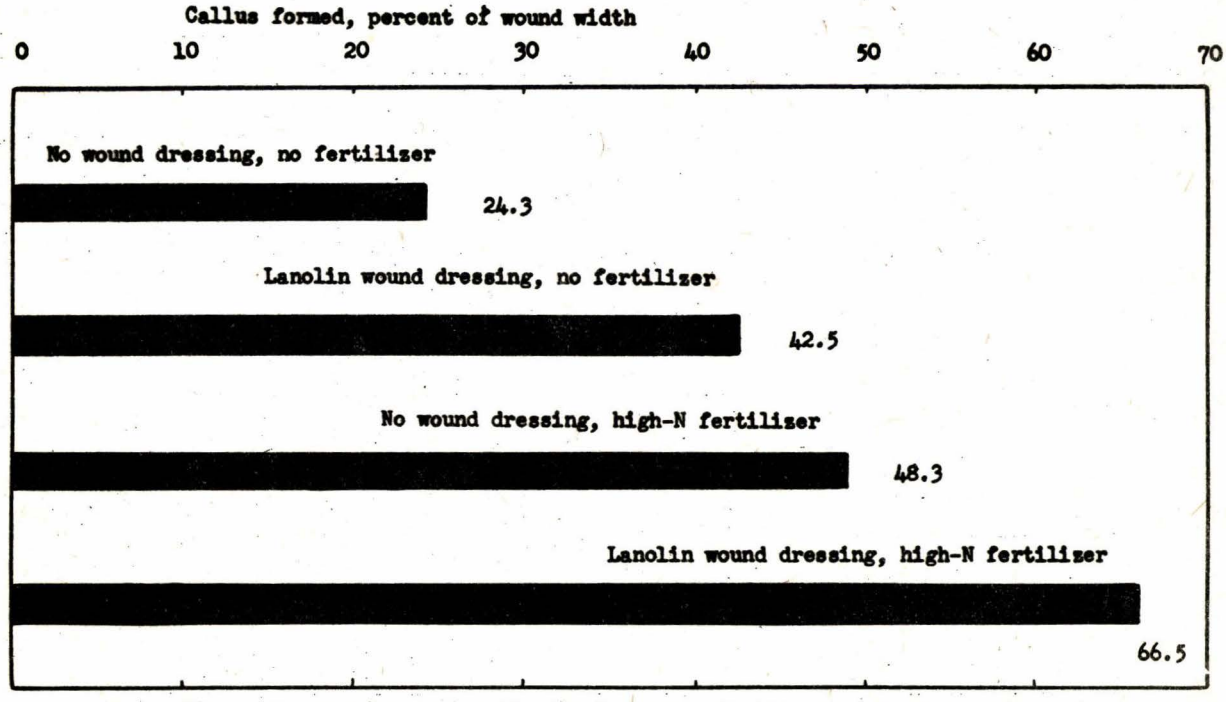


Figure 2. Healing during the first season of white oak wounds as effected by dressing the wounds with lanolin and applying high-nitrogen fertilizers about the base of the tree.

SELECTING GOOD SEED FOR FUTURE FORESTS

Once the war is won forest planting will very likely be resumed on a scale much larger than heretofore. With over 32 million acres in need of planting, the task confronting the nation is stupendous. The first step is to get adequate supplies of good seed. Tree seed has long been known to be highly variable, but the causes of variability were only vaguely understood. Studies made during the past year have added much to existing knowledge. Sound parentage for future forests can be assured and thousands of dollars saved in large planting programs by paying due heed to these results.

1. Seed origin affects drought resistance of seedlings. Survival of loblolly pine seedlings during the severe summer of 1943 was 65% for stock from North Carolina seed; 83% for that from Maryland seed. Shortleaf pine seedlings from Durham, North Carolina seed gave 55% survival, those from Asheville seed, 79%.

2. Hardiness of progeny varies among individual seed trees. Drought survival of seedlings from three individual loblolly pine trees from Durham, North Carolina was 61%, 68%, and 68%; that from three trees from the Eastern Shore of Maryland, 75%, 81%, and 94%.

3. Maturity of cones affects seed yield. Average yield of seed from cones of a single loblolly pine on the Eastern Shore of Maryland varied with collection date as follows: September 22, 1.43 grams; October 3, 1.65 grams; and October 22, 1.99 grams per cone.

4. Cone volume varies widely from tree to tree. Three pitch pine trees from Maryland showed variations in average cone volume from 19 to 43 cubic centimeters; three loblolly pines from Durham, North Carolina, 44 to 58 cc; three shortleaf pine from New Jersey 6 to 12 cc; three Virginia pine from Maryland, 10 to 15 cc; and three yellow poplar from Maryland, 10 to 13 cc. Variation in sizes of cones from a single tree was slight.

5. Large cones produce large seed yields. Loblolly pine cones of 27 cc produced 1.03 grams of seed; those of 56 cc, 2.25 grams.

6. Trees tend to produce the same sized cones from year to year. For four successive years, 1940 to 1943, average cone volumes from a single pitch pine were 40, 43, 35, and 39 cc.

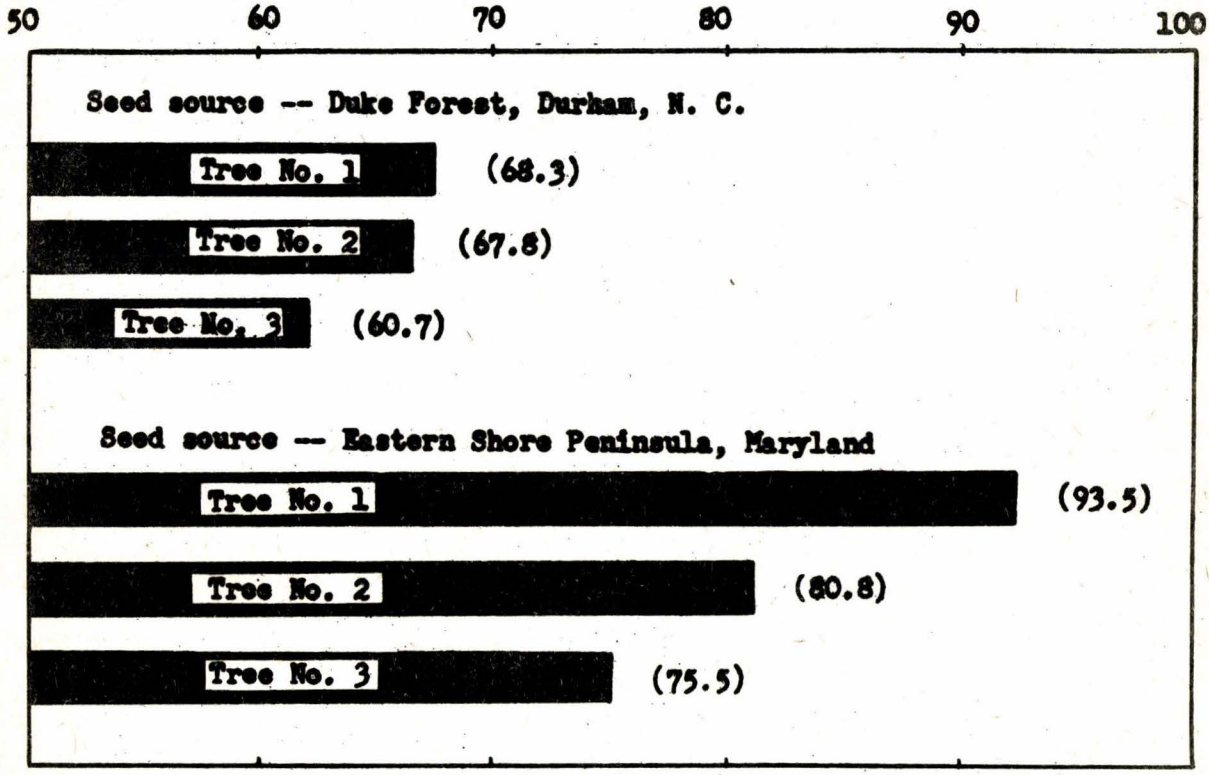
7. Some trees seem to be inveterate producers of poor cones. One shortleaf pine tree from Green Ridge, Maryland produced as few as 25 seeds per cone; a neighboring tree produced cones averaging 141 seeds each.

8. Blind seed can be separated from sound seed by flotation in liquids of proper specific gravity. Seed of pitch, Virginia, shortleaf, and red pine and red spruce that float in gasoline, turpentine, or 95% ethyl alcohol are usually less than 3% sound; those that sink in these liquids are more than 96% sound. Good seed of all species floated in 50% alcohol and of white pine in all four liquids.

9. Proper liquids do not injure seed. Seed immersed for 3 minutes in either 95% alcohol or in gasoline germinated as well as controls. Those immersed in turpentine germinated poorer than controls.

10. Penetrants or wetting agents do not increase water absorption by hard seed. Tergitol, aerosol (10%), and morpholine (0.1%, 0.5%, and 2.0%) had negligible effect on the water uptake of black locust, persimmon, loblolly pine, and white pine.

11. Shellac and lanolin coatings apparently prolong storage period for acorns. After 5 months storage in an outdoor pit and in stratification red oak acorns had germinated as follows: control 76%, shellac coated 48%, lanolin coated 2%. Further tests will be required to determine if such coatings injure the seed.



Survival during drought of loblolly pine transplants grown from seed from two different sources

FOREST SURVEYING WITH AERIAL PHOTOS

Timber -- where, what kind, how much? These are the questions asked by the ship timber operator hunting ribs for mine sweepers, the veneer cutter hunting birch for aircraft plywood, the harbor master seeking piling for docks, the sawmill man cutting lumber for munition boxes. These are the questions asked by the resin manufacturer seeking filler for plastics, the industrial planners seeking raw materials for new industries, the public works agencies seeking jobs for returning soldiers, and the lowly coal orphan seeking fuel to warm his family.

Yes, these are the questions which thousands of people ask almost daily, yet for which we in the Northeast have only the vaguest answers. We need to know how much timber there is in each state, we need to know its kind, its sizes, its rate of growth. We need to know its location within the state, and its relationship to topography, industries, and transportation.

We need this information for sub-regions within the states, such as the anthracite mining region, the white pine region of New England, the Eastern Shore of Maryland. We need to know it by counties -- yes, and even by towns -- so that local industries will know what supplies they have to draw upon. And timber buyers need to know it by exact location so that they can visit the timber tracts, appraise the logging conditions, and determine a price for the owner.

Answers to these three questions, pressing today, urgent for tomorrow, can be quickly, accurately, and cheaply provided as a result of the forest survey technique developed by the Allegheny Forest Experiment Station last year. The technique is new only in that it represents a refinement of steps hitherto advanced, and a synthesis of these and other steps into an overall design for large scale timber estimating. It is a combination of ground survey and reconnaissance with meticulous work on aerial photographs. Major forest types and sites are located by ground reconnaissance; forest areas and volumes are determined from aerial photographs; volumes are estimated by counting the trees on sample plots from the photographs and estimating the average heights on the basis of known heights computed from shadow lengths. Field checks determine the accuracy of estimates and provide information on species composition, growth, and yield.

The final step is to prepare county maps showing the location of each timber tract and an estimate of its area and volume. A section of such a map is shown on the opposite page. Cost of the entire job on a large scale basis is estimated not to exceed 2½ cents per forest acre. This contrasts with 4 to 15 times that amount for ground cruises of similar accuracy. Timber resources can be surveyed and millions of dollars saved by the new technique. Still further refinements that will cheapen the process and increase the accuracy are in prospect.

Tract number	Area acres	Total tract volume M bd.ft.
1	30	120
2	5	10
3	85	510
4	25	110
5	20	60
6	20	80
7	130	520
8	60	480
9	30	183
10	100	850
12	10	40
13	90	405
14	40	368
15	10	20
16	25	112
17	20	50
18	10	20
19	20	120
21	15	45
22	10	60
23	110	495
24	10	20
25	10	20
26	10	40
27	80	200
28	20	130
29	75	338
30	20	80
31	10	61
32	80	200
33	10	30
35	30	75
36	10	49
37	20	90

FOREST CONDITIONS IN A SECTION OF LACKAWANNA COUNTY, PA.

Saw timber Cordwood Young growth

Scale: 1 inch equals 1 mile

Foresters, land planners, and timber operators can quickly locate merchantable timber tracts through the use of aerial photographs.

A NEW FORM FOR THE STATION'S ANNUAL REPORT

This year the Allegheny Station has prepared a new type of annual report. It consists of three main divisions. The first is a section for popular distribution dramatizing outstanding results of the past year's work. No attempt is made to cover specific studies in a comprehensive manner. Data are attached to show examples of the types of results obtained, and the whole presented in interesting and readable fashion. This material should go to extension foresters, state foresters, woodland owners, and others. It can be used by newspapers and trade journals. It is really an advertisement of our wares and will be concluded by a list of publications gotten out by the Station during the past year.

Section two is designed for in-Service use. This goes to the Washington Office, to other forest experiment stations, to the Regional offices, and to the national forests within the Station's territory. It may also go to the Advisory Council and to important Station collaborators. This section is essentially the standard report of former years, giving accomplishments by projects. It covers progress in a more intimate and less objective way and gives specific credit for individual achievement. In this way it serves to fill the gap now left vacant by the suspension of the quarterly report of Station accomplishments.

The third section of the annual report is strictly confidential and goes to the Washington Office only. It consists of a discussion of the relation of the Station to various other forestry agencies in the area and to research agencies working in related fields, a report on Station personnel, specific information on factors influencing the progress of work on projects deemed too confidential in nature to be included in the in-Service report, and finally a frank statement from the Director of problems facing him.

If the report fills the needs of the Station and the Washington Office better than former reports, this new form is suggested for general adoption. Before crystallized in final form, however, it is felt that the Washington Office should review carefully all reports required from stations and determine to what extent they can all be included in a single annual report prepared at one time and covering all phases of the station's activities. This would necessitate, among other things, moving up the date for efficiency ratings from April 15 to February 1. This report is designed to place in the hands of the Washington Office staff material which can be used to justify budgetary requests, and particularly material that may be needed for planning estimates for the fiscal year two years ahead. The Allegheny Station will be pleased to learn the opinion others have of this report.

WAR JOBS

Wartime jobs continue to absorb the major effort of the Allegheny Station. Because these jobs have been more definitely crystallized, because their form is now better understood, and because the staff has been conditioned to take the new tasks in their stride, the war work has actually monopolized less of the creative energy of Station personnel during the past year than it did during the first war year. In other words, we are getting real efficiency into the war jobs.

This does not mean, however, that the Station can continue to turn out the volume of war work it now does with less personnel or less funds. It does mean that we still have a strong, well balanced staff and that we have had time to apply the same organizational skill to getting war work done that we apply commonly to regular Station work. It also means that the Station has been very successful during the past year in eliciting the cooperation of the Regional office, of the various states, and other organizations in helping with war jobs that were too big for the Station to handle with its own personnel. These contributions have been freely made by cooperating organizations. It is felt that this offers a pattern for future organization of Station work. What this means is that instead of obligating all our funds to salaries, equipment, and expenses to be expended by our own staff, we hold a reserve to be used with cooperating agencies and individuals in carrying on necessary investigative work.

Forest Products Requirements and Supplies Surveys

These furnish an example of how the Station has handled an increased volume of work with less expenditure of Station funds. The force engaged in this work has decreased from eleven to seven during the past year. The number of sample mills contacted has increased from 275 to 450. This better coverage has been brought about mainly by using mail and telephone contacts, and looking to the TPWP men to visit delinquent mills in the states of Maine, New Hampshire, Vermont, and Maryland. As rapidly as TPWP takes over in a new state, we arrange for them to handle the routine mill contacts.

Our own men are giving more attention to factors influencing production than they did last year. We still plan to visit most sample mills once in three months to get information on factors and stocks and to keep up their interest in sending in reports. Without these personal visits the mail canvass fails. We also get out local reports that are very popular with the mill men and with those interested in timber production in the region.

The task of preparing estimates of monthly and annual lumber production from the records of sample mills cannot be treated as simply a routine job. Last year, with three months only of sample records, we were able to predict the annual cut to within 4 percent of that revealed by the annual census. This year our estimate is likely to be less accurate because we found that samples inevitably became biased. Mills which we visited regularly tended to increase production and as a result were no longer typical of a class. As the TPWP program continues we can expect

their activities to have the same effect on all mills that our visits formerly had on sample mills.

According to our best estimate to date, lumber production for the northeastern region in 1943 will be 1,757,000,000 feet, as compared with 1,894,000,000 for 1942. Lumber stocks in the Northeast declined from 533 million at the end of 1942 to 285 million at the end of 1943, a decrease of 46.5 percent. A high percentage of the lumber nowadays is going directly from the green chain into the cars, or is held in the yards only long enough to accumulate a carload of given sizes and species.

The factors affecting lumber production changed but little during the past year. The labor and equipment difficulties are a little more acute. Weather was more favorable on the whole and costs of production and prices, though a source of considerable complaining, were somewhat less troublesome than the year before. The average sawmill owner has settled down to "sweating out the war". He has become inured to the questionnaire, directives, ceiling price changes, difficulty of getting replacement parts, and so forth. Output per men day is lower due to such conditions, but higher than expected because owners and experienced help are working harder and longer than they normally would. This is reflected by the shortage of some 25 percent in labor but an estimated cut of only about 7.2 percent less than last year's.

During 1943 the products supplies staff as a whole worked on a survey of wholesale and retail lumber yards, completed the field phase of the dry kiln survey, and made a new report on log transportation. Several minor special studies, among them estimates of food and clothing needs for pulpwood cutters, were carried out by Westveld.

Census of Lumber Manufactured

The census of 1942 was carried on largely by our products supplies organization, but we made use of many cooperators, several from NETSA, several from the national forests, and a few state men. Short assignments were given to Station men who are not a part of the products supplies staff. Taylor's efforts at organization brought high returns. The whole job was cleaned up in short order. It will be interesting to compare the results of this year's census based on a sampling procedure with last year's one hundred percent coverage and our own products supplies predictions based on our year-long sampling. As both will be based on sampling no one can say exactly what production has been.

Special War Tasks

Even before the war broke out, the Station was aware that shortage of shipping and submarine activity might cut off the quebracho supply, thereby making it necessary for tanneries located in the Northeast territory to seek local supplies of tannin. Preliminary surveys were made by the Division of Forest Pathology, Bureau of Plant Industry, to determine whether or not hemlock bark in storage at tanneries underwent serious deterioration from fungal attack.

Last spring, when the situation appeared more acute, Westveld spent some time studying the availability of hemlock bark throughout the territory and also considered what other sources of tannin might be available. Among the latter, red spruce bark appeared to be a promising source, especially since the bark is removed when the timber is cut for pulp. Samples of red spruce bark were selected and sent to the Eastern Regional Laboratory for testing tannin content. It was found that red spruce bark was just as high in tannin content as hemlock bark, but the purity of the extract from red spruce was low. By the end of the year the outlook for quebracho supplies from South America appeared more secure and, since any attempt to collect appreciable amounts of local bark seemed certain to interfere with lumber and pulpwood production, no effort has been made by government agencies to foster increased collections.

The Station was called into consultation by the Regional office to outline studies on commercial kok-saghyz production. Experiments were designed by Westveld to fit conditions at Seneca Falls, New York and at Burlington, Vermont, where fields had been planted to the Russian dandelion. Although some of the experiments were installed, none of them were followed through to completion due to unfavorable yields resulting from bad weather, poor germination, and contamination of the seed supply.

Schnur continued to serve on the Agricultural War Boards in New Jersey and Delaware, and Maki in Maryland. Bratton and Ferree served on county boards. During the first nine months of the year this service required a great deal of work by Station War Board members. Silas Little continued to service fire danger meters for the Regional office and state fire services, covering the territory from Cape Charles, Virginia through Long Island. In addition, Little collected special information on the functioning of the fire danger meters system as a whole and determined the intensity of work necessary if states were to realize full benefit from the system.

Postwar Planning

Even before our country became involved in the war, the Station had given considerable time and thought to forestry adjustments that would be needed after the war and how they could best be brought about. Inasmuch as the Station had no specific responsibility in postwar planning, our thoughts were confined mainly to developing the background for a postwar program of forest research in the Northeast. In the autumn of 1943, Gus Lentz, who was Forest Service representative on the Regional Postwar Planning Committee of the Department, found it necessary to withdraw on account of illness and the Director was appointed in his stead.

As soon as the reports from the Milwaukee Conference were available, the Station began active work assembling information on the forestry situation in the various states and preparing work sheets which could be used as a basis for state postwar plans in forestry. These were taken by Ray Taylor to Connecticut to see how the plan would work out. We had gotten this far before the Regional Chairman called a meeting of representatives of the land grant colleges with the regional committee to outline the program

of work designed to meet the Milwaukee Conference objectives. We assigned Forest Service men for work on state reports as follows: Maine, Marinus Westveld; New Hampshire, Victor Jensen; Vermont, James Vessey; Rhode Island and Massachusetts, Richard Jones; Connecticut, Ray Taylor; New York, A. B. Recknagel; Pennsylvania, Frank Ineson; New Jersey, Silas Little; Maryland and Delaware, Luther Schnur.

As of today, January 18, 1944, reports are near completion for all states except Delaware. We expect that the Forest Service will have completely fulfilled its obligations by the February 28 deadline.

FOREST MANAGEMENT

Additional Work Suspended

Many phases of Station work that required maintenance during the first year of war were brought to a stage where suspension for the duration was feasible. Work at Hopkins was discontinued and the station closed after Schreiner moved all his nursery stock from there to Beltsville and Philadelphia. Work at the Standing Stone Experimental Forest has been discontinued. No work at all was done at the Gale River, Bartlett, Massabesic, Chenango, and Eastern Shore Experimental Forests. Some plots were remeasured at the Finch Pruyn Experimental Forest by Professor Recknagel. The Kane Experimental Forest was open for a short while during the summer.

It is extremely difficult to place an active project on a maintenance level. This implies a state of suspended animation or dormancy from which the project can be reawakened without loss of vigor. We can come close to doing this when the project leader is assigned to related war duties at the Station. Our northern hardwoods studies are an example. Hough has been carrying on RPS surveys in the northern hardwood region and special war studies in cooperation with the State of Maryland. Sufficient time was found to remeasure some of the sample plots on the Kane Experimental Forest, so the northern hardwood project has been kept alive at a maintenance level.

Elsewhere we were not so fortunate. A good program of work was started in the oak type at the Standing Stone Experimental Forest by Stevenson, Bramble, and Meyer of State College. All of these three men have now left the College for the duration and as a consequence little is being done to maintain the work. Professor Cope has assumed responsibility for looking after the physical property but the experimental work has of necessity been dropped. There is little prospect of picking it up again without loss of most of the effort these men put into it.

War Jobs in Forest Management

During the past year the forest management staff has carried several more or less extra-curricular activities designed to help the war effort directly or to help war agencies or war activities of our own organization.

One of the first jobs was to get together the best information we now have available to guide private owners in cutting timber for war. Six War Log pamphlets, one for each of the important types in the territory, were prepared by Taylor. Later these were combined into one single manuscript entitled "War Logs". It was hoped that this could be published promptly to stimulate log production by farmers and others. It was a hurry-up job carried out to fill a specific need. The manuscript prepared early in the year is in Washington still awaiting publication.

Sample scaling was suggested by the Washington Office as a means of cutting down the amount of work needed in administering timber sales. At the specific request of the Washington Office, the Station undertook a study of the feasibility of sample scaling for the Northeast. Analyses by Westveld of data from the Green Mountain National Forest scale books showed logs to have a coefficient of variation of 70 percent. This meant that sample scaling could be applied on sales involving 10,000 logs annually or more, but inasmuch as very few of the sales in this region involve anywhere near 10,000 logs annually, and as the value of the timber is high, it was found that sample scaling was scarcely applicable. This finding was anticipated before the study was undertaken, because it was realized that the actual time required to scale logs is small compared with that involved in traveling to and from the sale area.

As background for farm foresters, TPWP, and others, the Station in collaboration with the Regional office spent considerable time trying to work out minimum standards of forest practice applicable for the Northeast. In addition, Westveld has been serving as chairman of the committee of the New England Section of the Society of American Foresters working on cutting practices. This committee has set up eleven sub-committees, each having representatives of industry, state forestry organizations, and others. The committee has been quite active and it is believed that this attempt to get regulation down to brass tacks is doing a lot to clear the air throughout the territory. Hough collaborated with the State Forester of Maryland in outlining cutting practice rules for the hardwood type.

Westveld has been serving as chairman of the committee of the New England Section developing a forest type map for the region. A fairly accurate type map has now been prepared for the entire territory served by the Allegheny Station. Westveld has handled New England, Littlefield New York, and Hough the Allegheny Station territory. Naturally more refinements are needed and these will be made as more data become available for committee use. These maps have proved valuable in postwar planning and also for sending to industries searching for plant locations.

At the specific request of the Maryland State Forester, the Allegheny Station carried out a study of the relationship between tree diameter and cost of mine prop production in the soft coal region of Western Maryland. In contrast with studies on pulpwood production and chemical wood production, Hough found that small trees down to 3 inches in diameter are not a handicap to rapid production of mine props and high daily earnings by the workmen. This is because the props sell by the linear foot and only small sizes are desired. Props made from trees large in diameter must be split, and splitting consumes considerable time. However, partial cutting

did not increase the time required to produce props. As it decreases the interval between cutting, it is of considerable advantage to the landowner.

At Beltsville a study of the effects of various chemical substances on the preservation of cotton seedbed cloths was carried out in cooperation with the Bureau of Home Economics and Human Nutrition. Treatments with lead acetate and potassium dichromate prevented deterioration in the breaking strength of cotton cloth for a period of three and a half months under conditions in which untreated cloth deteriorated 20 percent. One commercial preservative also proved advantageous. Only one of ten treatments tested proved toxic to seedlings, and that was the treatment with cadmium chloride.

Spruce-Fir

Throughout the year Westveld has worked on a comprehensive handbook of spruce-fir management based on some eighteen years' research. The writing phase of this began as the final stage of a growth and yield project, but as previously published material is bulky and new ideas for use of older data have developed, it was decided to put out a management handbook. This nears completion and would have been completed now had other jobs not interfered. The outstanding result is that shorter cutting cycles greatly increase -- almost double -- the harvest of pulpwood, because they make possible use of fir that otherwise would rot.

All field work on this project is shelved for the duration. A limited amount of service work of special war or postwar significance is being continued. The big job for the coming year is to complete the handbook and plan a five year research program, while continuing service work that must be done.

Oak-Pine

Little, expecting to be drafted early in March, made a special effort to bring up to date the results from all studies under way at the Lebanon Branch Station. In this he has been quite successful. In South Jersey, much higher values can be realized from pine forests than from oak. The latter grow very slowly on the poor soils of the Pine Barrens, yet oak sprouts and seedlings are aggressive enough to prevent pine seedlings from becoming established unless some steps are taken to discourage the oak and encourage the pine.

Little has found that this may be done by mechanically scarifying the soil or by controlled burning. Mechanical treatments were effective in providing good mineral soil seedbeds for new seedlings. Plowed areas have produced twenty-five times as many seedlings as check areas, and disked areas nine to thirteen times as many. Broadcast burning areas have produced three times as many seedlings as control areas.

Repeated tests on permanent sample plots and on safety strips burned along roads have shown that controlled burning can be used safely and effectively to encourage pine reproduction in South Jersey if under skilled supervision. Two to five burns during a five-year period reduced

the average size of shrubs by at least 30 percent to 40 percent, and the area covered by shrubby growth from 10 percent to 30 percent. The net result of the studies is that controlled burning has a definite place in the silviculture of New Jersey's Pine Barrens, if promptly and skillfully applied. One or more burnings costing 15¢ to 60¢ per acre are usually desirable to expose mineral soil and to reduce the amount of competing vegetation. After the burns it may be necessary to make one or more cleanings in order to bring the pine through the sprouts. Total cost of the pine stands using this method is estimated to be about $8.00 cheaper than can be obtained by planting or by mechanically treating the soil. At the request of Region 7 no release of this information is planned for the present.

Little's study of the regeneration of Atlantic white-cedar on hardwood swamps and on the poorly drained soils adjoining the swamps have indicated:

1. For good germination and rapid growth of seedlings, rather open conditions are necessary.

2. White-cedar grows much slower on poorly drained St. Johns soil than on the true swamp sites. It is questionable whether pitch pine or white-cedar will yield the greatest returns on the St. Johns soil type.

3. White-cedar produces viable seed at a very early age, three to four years. Natural seedlings or planted trees of this age can be relied upon to fill openings provided seedbed conditions are favorable. Animal browsing causes extensive damage to white-cedar reproduction. Efforts to convert hardwood swamps to cedar should be concentrated on areas where animal damage is at a minimum.

4. The exact influence of the water table on the behavior of white-cedar reproduction remains to be worked out. This is important and should receive early attention.

Little has completed a bulky manuscript dealing with the successional stages in South Jersey lowland swamps. This is not yet ready for publication.

Plans for next year include inaugurating under state supervision a series of large scale controlled burning tests. Further phases of the cedar study will be brought to completion. Additional analyses of fire records will be made to determine further means of increasing manpower efficiency.

Genetics

Most of Schreiner's time and effort during the past year was taken up in moving the large volume of stock from Hopkins to Beltsville and to the Morris Arboretum. Here it was set out in nurseries and some of it in out-planting plots. Heavy losses were sustained in the Beltsville out-planting plots because of the severe drought that occurred during the summer of 1943. Fortunately, less than 5 percent of the stock derived

from controlled breeding was out-planted where it suffered heavy loss. The records are now being examined to determine whether or not some clones proved more resistant to the drought than others.

During the past year a small study was completed on the effect of fruit production on the rooting of red maple cuttings. This indicates that poor rooting is associated with the amount of flowers or fruit produced in any one year and not with the sex of the parent tree.

Studies of hybrid poplars have indicated that sod exerts an inhibiting effect on the growth of poplar cuttings, and that sensitivity to this inhibiting effect varies among different clones. Apparently the effect is due to uncongeniality between the poplar roots and grass roots. A test made in the greenhouse indicates that within a few weeks time water which has leached through sod will reduce significantly the rate of growth of poplar hybrids. Schreiner considers this particular finding to be mainly of theoretical interest. It implies that clones can be found of such valuable species as red maple, sugar maple, white ash, and other hardwoods that will be particularly valuable in planting up abandoned farm land.

A big job in forest genetics research that remains to be completed is to analyze and write up the results of the past six years breeding work and to reorient plans for the coming five year period. Tentative plans should also be prepared for large scale rapid breeding tests should an emergency work program become available for furthering forest research. These tasks will consume a large part of the research effort during the coming year, together with the amount of time that must be spent to care for existing breeding stock.

A word of explanation is in order as to the possibilities of carrying on a large scale breeding program with emergency funds. Much of the technique of breeding various species has already been worked out during the past six years. It is a relatively simple matter to locate now trees possessing desirable characteristics and trees of various species for inter-specific hybridization. The actual breeding operations are simple and can be carried out by unskilled workmen after a brief period of training. One technician can supervise crews of three or four workmen. A large amount of very useful work can be accomplished during a two year work program, provided plans are carefully laid now based upon past experience and careful study of potentially useful prospective hybrids.

Fundamental Studies

Outstanding progress was made in fundamental studies at Beltsville. An exceptionally large volume of experimental work was carried out using the CPS men as assistants. Special credit should be given to the staff, Maki, McQuilkin, and Ostrom, for careful planning and accurate performance of experiments. Special credit is also due to Doctors Marth, Hamner, and Stewart of the Bureau of Plant Industry, Chemistry and Soils for their cooperation on this research work.

All of the studies mentioned below were undertaken at the behest of the Army Engineer Board which was interested in improving handling technique for plants used for camouflage. The more striking results of this work are included in the popular section. This discussion is more for the purpose of outlining questions to be considered in planning the program ahead.

The work with plant growth regulators can be summed up, on the whole, as somewhat disappointing in that no beneficial treatments were found that could be recommended for immediate practical use. Work in this important field of plant research has proven to be tedious where practical results are the end desired. We were successful in demonstrating that growth regulators properly applied tend to increase root growth and decrease top growth, and to prolong dormancy, a new finding insofar as forest planting stock is concerned.

Theoretically, it should be possible to determine the proper application of growth regulators that would induce rapid root growth in stock for field planting and slow top growth. It should also be possible to find the proper concentration that would prolong the dormant period for two or three weeks and make possible late spring planting. Attempts to work out both of these, however, have so far been only partially successful. In the first place, the borderline between the concentration that produces the effect desired and one that injures is very narrow in conifers. Also, the concentration at which the effect is produced seems to vary with the physiological conditions of the plant at the time of application. For instance, a concentration which in the 1942 tests was easily tolerated by two-year-old loblolly pines killed nearly all of the plants of a different lot of loblolly seedlings of the same age treated in 1943.

It is obvious, therefore, that a large volume of additional research must be carried out before practical treatments can be recommended. Also, we must have considerable research to determine the true value in terms of survival of the effects which theoretically should prove favorable. We have talked over with representatives of the Bureau of Plant Industry the desirability of continuing research on plant growth regulators at a somewhat reduced volume during the coming year. They have indicated their willingness to continue the cooperation, which includes making available the growth substances for treatments and advice on special problems.

Our studies on tree wounding have been quite successful. The most usable results so far have been the value of lanolin as a wound dressing. Our studies also reveal that single applications of growth substances in the proper concentration appear to speed up the rate of wound healing to a slight extent. Possibly periodic application would speed it up even more. The finding that fertilizing of trees greatly speeded up the rate of healing was more or less to be expected.

Inasmuch as this study has little application in forestry, some question exists in our minds as to whether or not it should be continued much beyond the present stage. Its chief value is for the shade tree specialist. I am sure, however, that a vigorous followup of this work would be

fruitful. Our present plans call for following it up on a very limited basis.

Our demonstration that sapling-sized spruce, arborvitae, maple, and ash can be transplanted in mid-August is quite striking and worthy of some publicity. Also the values of top pruning, balling the stock, and quick feeding with fertilizers merit attention. We have done some good work with this large-sized stock. Again, however, this is not strictly a forestry problem and some question exists in our minds as to the desirability of continuing such experiments. No plans have been made for immediate followup.

No question as to usefulness in forestry arises with respect to our studies of seed and nursery stock. According to preliminary estimates by postwar planners, the Northeast has upwards of 4 million acres in need of planting. We therefore feel justified in continuing a certain amount of seed and planting studies at Beltsville on species that would be used in the eastern United States.

The various ramifications of the seed studies that we carried on during the past year produced highly interesting results. It seems as if we are now, more than ever before, in a position to define definitely the characteristics of a good seed tree. This becomes the more important as states such as Virginia, Washington, and others pass seed tree laws.

To get uniform material for experimental use we have followed the policy of collecting seed from individual mother trees, year after year. Naturally, this gives us information on the performance of progeny of which one parent is known. We have also been observing performance on regional strains. This work, though involving the technique of physiology, properly falls within the field of forest genetics.

The value of certain fatty or waxy coatings in increasing drought resistance apparently has been clearly demonstrated. However, we need to follow this up with certain field tests to make sure that drought resistance built up through foliage sprays does not cause injury during hot weather late in the summer. Of outstanding importance has been the finding that quick feeding with fertilizers applied during the dormant season enhances drought resistance of stock out-planted the following spring. Just what this quick feeding actually accomplished is, of course, not known.

Studies of nutrient requirements of seedlings quite obviously fit in directly with the studies of preconditioning planting. The two must, in fact, be carried hand in hand. The whole field of problems involved in preconditioning stock for field planting, in storing stock, and in holding stock dormant in the spring so clearly fall into the fundamental field and so obviously will be highly useful in the postwar period that I feel we should give high priority to this work.

Fertilizing large-sized trees has been undertaken on a limited scale at the request of the Division of Soil Chemistry and Physics, Bureau of Plant Industry. How far we should go with these studies is questionable.

It should be mentioned, however, that American foresters generally have neglected chemical fertility of forest soils as yield factors, though considerable attention has been paid to it in Sweden. It is almost certain that we do have large areas of forest soils that are deficient in certain nutrient elements, and it is highly possible that studies in this field might ultimately yield results that could be profitably applied. Meanwhile, the results obtained will be highly useful to arborists and shade tree specialists. Furthermore, for special forest products such as seed for restocking cutover areas, and so forth, the application of small amounts of fertilizer might well be justified. Fertilizing seed trees to improve quality as well as quantity of seed looks like a promising field of inquiry.

Little progress has thus far been made on soil studies at Beltsville. We will soon want to open up this field of investigation on a more extensive basis than heretofore. Our finding that certain bare sub-soil areas became quickly clothed with grass if fertilizers were applied would seem to offer an important key to stabilizing raw banks and possibly to planting up many severely eroded fields. There is evidence at Beltsville that this is the case.

FARM FORESTRY

The Connecticut farm forestry research project was started in the fall of 1939. At the time the following six jobs were planned: (1) tests of boiler at Niantic State Farm for Women, using coal as fuel; (2) tests of boiler at Niantic State Farm for Women, using hogged wood as fuel; (3) production of hogged wood; (4) tests of wood-burning heaters; (5) fuelwood production cost studies; and (6) development and operation of a portable charcoal kiln.

The first three jobs were all a part of the studies on the effectiveness of using hogged wood as fuel to heat a state institution. In these studies we had the cooperation of the Connecticut State Park and Forest Commission, the Connecticut Agricultural Experiment Station, Yale University, a private consulting engineer of New Haven, and the Niantic State Farm.

With the completion this fall of the tests of operating the boiler on hogged wood, these three phases of the farm forestry project were concluded. Final results of the tests are not yet available. Some difficulties were encountered with the hogged wood feeding equipment, inasmuch as long strips of wood tended to bridge in the hopper and sometimes carried the fire from the combustion chamber back to the hopper. This mechanical detail could be corrected by more efficient equipment.

Bratton made a number of tests on wood-burning heaters during 1939 and 1940. This work was followed up in 1942 by Trimble. In addition, Hicock of the Connecticut Agricultural Experiment Station designed a so-called "dutch oven" for burning wood in furnaces. Such a unit was installed at Cooperstown in the building occupied by the CPS Camp, where it has given very satisfactory performance so far this year. The furnace heats the house much better with wood than it did with coal and delivers higher

efficiency, inasmuch as a cord of wood is giving a heat output by the furnace equivalent to a ton of coal. Tests of heat output are now being run at Cooperstown.

Some information was obtained on fuelwood production costs during 1940 and 1941 when the Station was cooperating with the Quinebaug Forest Company and also with the State Forester who had CCC and ERA labor at his disposal. Special tests were run on small power saws. During the current year we are concentrating mainly on cordwood production costs. New methods of skidding and new crew organizations are now under test. Other types of power and hand equipment will be tested as opportunity affords. The Connecticut Forest and Park Association and the Connecticut State Forester are cooperating actively with the Station on this work. Past findings indicate that still further savings in labor and other costs are possible.

FOREST ECONOMICS

New Standards for Forest Survey

The line-plot survey technique as applied to large areas has been completely outmoded by the aerial photo survey method developed by the Station during the last year and applied to eight counties in the Anthracite Region. The Station claims little originality for this method. Its full potentialities were envisaged by Ellwood Wilson as early as 1927. They have been glimpsed by others who have used aerial photographs as a means of supplementing ground work in timber estimating. The estimation of timber volume from tree heights computed from shadow lengths was borrowed directly from the Canadian foresters and its accuracy improved through extensive experiments.

The Station has reviewed the various processes which have been developed, refined them, and synthesized the whole into a workable pattern for large scale forest surveys. It has applied this pattern over a sufficiently large area -- a gross area of over 2,500,000 acres -- to demonstrate its feasibility. The Station makes the bold prediction that this new survey pattern, with essential refinements now under way, can be applied to large forest areas at little if any increase in cost over present day line-plot technique, and will provide a reliable estimate for areas as small as counties and even large townships.

The method involves the following steps:

1. A general reconnaissance of the territory to classify the principal forest types and major variations in site quality within each type.

2. Preparation of total height volume tables for each forest type or site quality area.

3. Estimate of total forest area through multiple plot counts from aerial photographs.

4. Making area and volume estimates for each forest type and site from aerial photographs. This is done by computing tree heights from measured shadow lengths on each photograph; comparing stereoscopically heights of other trees with those of known height; counting the number of trees within fifth-acre or larger plots laid out on the photographs; estimating volume per acre based on number of trees and average tree height for each tract in the county; differentiating between ten acre and larger tracts having 2,000 board feet or more on each acre classed as saw timber; and those having five or more cords per acre but less than 2,000 board feet, classed as cordwood stands. The volumes in cordwood and saw-timber tracts are summed up separately to give the total volume in a county or township.

5. Field checks on individual tracts to determine the accuracy of estimates from the photographs, to collect information on diameter class distribution and species composition, and to obtain a basis for estimating volumes in small trees in saw-timber stands. At the same time increment cores for growth estimates are taken. Care is taken to select samples of merchantable tracts well distributed throughout the entire range of volume-per-acre classes within each principal type. This is necessary to obtain weighted data on the distribution of volume by species and diameter classes, as well as for reasonable application of growth data. Field survey may be made to determine average volume per acre, species distribution, and age classes of young-growth areas.

If several years have elapsed since aerial photos were taken, it is necessary to make a reconnaissance of the merchantable forest tracts to determine whether or not they have been cut. This provides a direct estimate of drain, although allowance must be made for cutting in unmerchantable stands. This should be supplemented by drain information obtained through surveys of consumption by industries and farmers. Data on ownership of forest lands can usually be obtained during the course of the field reconnaissance.

A by-product of this survey design is the estimate it provides of volumes in individual tracts. Our field checks have indicated that such estimates are within 20 percent of the actual, nine times out of ten. Errors are largely compensating. The errors for counties appear to be less than 5 percent. The Station has published maps of two counties showing the location, area, and volume in each saw-timber and cordwood stand ten acres and larger. Such information is of extreme value to timber buyers, to prospective wood-using industries, to county officers engaged in planning, and to farm foresters.

The great utility of this information as compared with that obtained by the line-plot technique justifies immediate reexamination of forest survey methods. The new method has worked successfully in the Anthracite Region where the stands are largely evenaged. We are now refining it for application in unevenaged stands and hope that within the next two years we will be given the opportunity to carry out the necessary preliminary work to prepare detailed plans for applying this technique throughout the Northeast.

The Station is proud of this achievement which has been the result of painstaking effort on the part of Clement Mesavage, Earl Rogers, Frank Ineson, and Miles Ferree. The work has been done on standard AAA photos using no more complicated instruments than the double lens stereoscope costing about $5.00. What further reductions in ground work could be effected through using the newest techniques in aerial photography and photo-interpretation can only be surmised today. Funds should be made available at once for exploring the possibilities offered by the latest techniques.

Anthracite Forest Survey

Sufficient progress has now been made on the Anthracite forest survey to enable us for the first time to predict with assurance that the major long term objective which Congress had in mind in appropriating money for this survey can be achieved. The forest lands of the Anthracite Region are more than sufficient in potential productive capacity to provide all the timber that the mines require plus a substantial surplus for new wood-using industries.

Preliminary results from our field surveys indicate that the Anthracite Region, with a gross area of 5,254,000 acres, is 63 percent forested. Although less than 10 percent of the forest area is in saw-timber stands and only about 20 percent in cordwood areas, the region has nearly 20 million cords of wood in trees 5.0 inches and larger, of which saw-timber trees contain more than two billion board feet. Translated into terms better understood in the region itself, the total volume of growing stock amounts to more than 40 million tons.

The anthracite mines require slightly over a million tons of wood annually in round and sawed material; this constitutes 80 percent of the annual drain of about 1,300,000 tons. Requirements were somewhat larger in 1943, but it is doubtful if such demands will be continued regularly in the postwar period unless new industries are introduced. Although the anthracite mines import from outside the region most of the lumber they require, and a portion of the round material, the growth of the region could take care of the volume consumed. The region will always require some high quality lumber from outside.

During 1943 the forest resource phase of the survey was completed for the entire region. Forest areas and volumes were computed for each of the 15 counties. This entailed field inventory work in more than 60 percent of the region, covering 10 counties with a gross area of nearly 3,500,000 acres. The forest area of each township was estimated through a detailed sampling procedure using aerial photographs, and combined to provide revised estimates for each county. Maps showing the location of forest land, mine waste banks, urban areas, and open areas have now been released for each of the counties (6 were completed during 1943 and improvements made in 6 others). Maps showing the location of saw-timber and cordwood tracts 10 acres and larger were prepared for 8 counties and two of these published with detailed estimates of the area and volume of each tract. A map showing the location of forest tracts 50 acres and larger was prepared for the entire region, about half of which has also been mapped for forest types.

This progress in resource inventory, compilation, and mapping was made notwithstanding the discontinuance of a WPA project of about twenty-five individuals in January and a reduction in allotment from regular appropriations of several thousand dollars. In the face of these discouragements the ingenuity and industry of Ineson and Ferree made last year top all others in work output. The project was staffed with the equivalent of two technical men for the full year, with on the average two assistants from Civilian Public Service Camp No. 12 at Cooperstown, New York.

Early in the year a comprehensive report was published on the forest resources of Luzerne County and a brief pictorial report has been made ready for publication, but will probably be held up until the end of the war. Although practically all of the effort of the small staff was engaged in field inventory, compilation work, and mapping, reports were initiated for three counties.

While rapid progress on the survey was being made by the Station, equally gratifying progress on the action program was made by Stanley Mesavage of the Industrial Forestry Department of the Wyoming Valley Chamber of Commerce. He greatly expanded and applied forest management programs during the year and continued his program of better fire protection.

Forest management had a further boost through the assignment of a farm forester to Luzerne, Wyoming, and Lackawanna Counties under the direction of the Pennsylvania Department of Forests and Waters, but sponsored by and quartered with the Wyoming Valley Chamber of Commerce. Both the Department and the Chamber cooperated wholeheartedly with the Station in pushing the overall program.

During 1944 it is planned to publish brief reports of the mine timber and other forest resources of the balance of the region, probably issuing about six reports in all. In addition it is hoped to turn out recommendations for forest management in the northern hardwoods of the region and to do some work looking towards a similar publication for the oak-pine type. Forest condition maps will be completed for the remaining counties and regional maps prepared for forest area and forest types. Further work will also be carried on to refine growth and drain estimates.

Forest Cooperatives

With an adequate modern sawmill located in the midst of what was believed to be an abundant timber supply, why could the Otsego Forest Products Cooperative Association of Cooperstown, New York not get enough logs for full time operation? And why, with hungry war markets, should they fail to make money? These were the questions that faced the cooperative, and these were the questions Ineson and Bratton sought to answer.

The Station's work with the cooperative has been justified mainly on the basis that it would provide information applicable to forest and sawmilling cooperatives elsewhere. Progress last year fully redeemed this expectation. Furthermore, results have been achieved that can be applied in appraising forest management prospects through volunteer effort in any similar farm forest area.

Originally, the timber available to the Otsego Forest Products Cooperative Association was estimated by examining a number of sample farms. Later, a complete forest inventory was made using line-plot survey technique. Studies during the past year have shown that both of these methods grossly overestimated the volume of timber that could be made available to the cooperative. In the first place, the sample farms turned out to be biased on the side of better than average timber holdings. The line-plot survey is believed to give us an accurate estimate of the total timber growing on lands within twenty-five miles hauling distance of Cooperstown. But experience had shown that nowhere near the amount estimated to be present was being made available to the cooperative. An attempt to discover the reason why was undertaken.

Using aerial photographs, all woodlands having ten acres or more in saw timber have been located. These are being checked to determine whether they are in a single ownership or divided among several owners. Individuals found to own ten or more acres of saw timber are then interviewed to determine their interest in selling timber under permanent forest management. Prospective members discovered in this way are referred to the field men of the association, who have been successful in signing substantial timber contracts with them. The Station was fortunate in having available in the local CPS camp two men with special training in sociological studies and statistics who are doing much of the work on this study. For the area already covered by this survey, the results are shown below.

Availability of saw-timber tracts to the Otsego Forest Products Cooperative Association, based on a sample of 64,000 acres

Item	Area
	Acres
Gross land area	64,000
Total forest area	22,000
Saw timber in tracts 10 acres and larger	4,000
Saw-timber holdings in individual ownerships, 10 acres and larger	3,600
Available after subtracting lands held for recreation, tied up in estates, mortgages, or otherwise unavailable	2,700
Owned by individuals willing to sell through the cooperative	1,600

When completed it is believed this study will furnish information widely useful throughout the farm forest region of New York and possibly applicable elsewhere to cooperative forestry ventures. The technique used in this study can be applied in sizing up operating potentialities in any farm forest area. Generally speaking, approximately ten acres of timber land are necessary to supply fuelwood, posts, and custom-sawed lumber for use on the farm. Such small tracts cannot be relied upon to furnish substantial volumes for outside use. Furthermore, they are expensive for timber contractors to handle on a selective basis because of the small volumes involved.

The amount of timber tied up by mortgages and estates and for recreational and aesthetic purposes is an estimate. Naturally it will vary a great deal from region to region, but in the populous eastern states it can be anticipated that this will amount to a considerable percentage of the whole. After all other necessary deductions have been made, the estimate that 60 percent of the remaining timber can be signed up by the forest cooperative reflects the experience of the Otsego. This is not a bad achievement. A better record of performance on the part of the cooperative and further education might increase this percentage.

Our studies of the availability of the forest resource to the Otsego Forest Products Association has led to the inescapable conclusion that mill capacity far exceeds current and foreseeable future operating possibilities. Originally the mill was designed with half time operation in view, but heavy pre-operating losses accrued as a result of using relief labor and attempts to achieve other laudable objectives not strictly necessary for the business. These caused indebtedness to increase to such an extent that only full time operation at a high level could possibly provide a margin large enough for carrying charges. For more than two years every effort was made to achieve an average operating level of 300,000 board feet per month, with the inevitable result -- further losses.

Preliminary analyses indicated that half time operation might prove feasible, provided adjustments in indebtedness could be effected. Operating returns since last August when the new schedule was put into effect have borne out this prediction. The association can just about break even if debt service charges are reduced to those required by an $80,000 total investment. This is the value of the association's assets at an operating level of 150,000 feet of logs per month. An attempt is now under way to get the debt adjusted to the new appraisal. If the debt can be so adjusted we can confidently say that the prospects for the association are brighter than they have ever been at any time in its history.

Substantial progress was made last year in studying the lumber grades that can be sawn from logs of various grades, as a basis for adjusting prices on a log grade basis and also as a basis for estimating the value of standing timber. Attempts are now being made to estimate the log grades that can be realized from standing trees, which should make possible much more accurate appraisals on the part of the association. Information of this type is badly needed by private operators, farmers, and farm foresters, as well as the cooperative.

During the coming year it is planned to complete the tree grading study and to test its applicability to the cruising technique. We hope also to complete an analysis of the availability of the entire forest resource within a 25-mile hauling distance of the mill, based on the technique described above. To date this job is approximately 10 percent completed. Studies of grade yield, stumpage and labor returns to woodland owners, of felling, bucking, skidding, and hauling costs that have already been initiated in a small way are to be continued. A financial history of the association will be completed. Additional information on the growth of stands selectively cut in past operations of the association should be made to improve operating forecasts and also to obtain more convincing

information on the value of forestry measures to the local farmers. Routine administration of the loan and other aid to the cooperative will be continued as in the past. Special efforts will be made to have the loan adjusted to its true value.

FOREST PATHOLOGY

(Bureau of Plant Industry, Soils and Agricultural Engineering)

Termination of Continuing Past Projects

The two principal long term projects -- Decays in Living Balsam Fir and Decay of Logging Slash in the Northeast -- are practically terminated by submission of manuscripts in final form for publication as technical bulletins of the Department.

Current Work on Past Projects

This has consisted chiefly of two investigations:

1. Final taking of data on beech-Cryptococcus-nectria plots handled in cooperation with the Bureau of Entomology and Plant Quarantine for the past ten years. The disease is spreading steadily westward in Maine. It was discovered last summer in the vicinity of Bethel, Maine, nearly on the Maine-New Hampshire boundary, a considerable distance westward of any previously known outbreak area.

2. Reexamination of areas in the vicinity of State College, Pennsylvania, where the CCC attempted eradication of Strumella in heavily attacked young oak stands in 1934. Because of the extreme prolonged drought in that area preceding and during our examination, which suppressed fruiting of the fungus, reliable conclusions cannot be given as to the effect of the treatment.

War Projects

Much of the work of the past year has been devoted to investigations of war problems, such as the decay of wood in aircraft and the significance of discolorations in aircraft veneer of different species.

FOREST ENTOMOLOGY

(Bureau of Entomology and Plant Quarantine)

During the past year, special investigations covered the following topics:

Beech Scale

The beech scale that has heavily infested beech timber on the White Mountain National Forest underwent no appreciable mortality as a result

of low temperature last winter. As present infestations are local, the forest supervisor plans experiments next year to control the insect. The most promising methods include cutting trees during winter for fuel and spraying the stumps with a contact insecticide the following summer, and possibly injecting chemicals into the sap stream.

European Sawfly

Noticeable defoliation has occurred in red pine plantations near Litchfield and Southington, Connecticut during the past two years. Some trees and groups of trees have died and bark beetle populations are building up. Date of emergence from over-wintering cocoons varies as much as ten to twelve days in plantations separated by only a few miles. At Southington in the area where the heaviest sawfly feeding occurred, the first part of the summer, the cocoon parasite Microplectron fuscipennis was extremely abundant. Thousands of the tiny adults were observed crawling in the duff beneath the trees on August 12. Observations should be made this coming spring to determine the effect this parasite has had on the sawfly population.

Leconte Sawfly

Since 1937 this sawfly has been causing serious damage in red pine plantations in northern New York. White pine was damaged relatively little. Most severe damage occurs where the trees are less than ten feet in height. In one plantation of 45 acres, eight to nine years in age, 80 percent of the trees on 25 acres were dead or dying. The most serious infestations appeared to occur in the Adirondack Mountain region and north and west of it.

White Pine Weevil

In cooperation with the Harvard Forest, Yale Forest School, New York Conservation Department, and the Connecticut Forest and Park Association, studies have been made of the practicability of controlling white pine weevil by applying concentrated lead arsenate spray to the leading shoots to kill adult weevils before eggs are deposited in the spring. Examination of about 50 acres of white pine treated with concentrated spray in 1942 and 1943 at North Guilford, Connecticut, showed 99.9 percent control. During 1942 approximately 10 percent of untreated trees were attacked and in 1943 the closest untreated stand observed showed 12 percent attack.

Black Cherry

Studies have been initiated on the Harvard Forest to determine the possibilities of improving survival and growth of black cherry reproduction. Twig injuries result from three causes: dieback, possibly due to cold; bark feeding by insects on twig tips; and bud gall caused by Cecidomyia serotinae. Tent caterpillar was found to reduce growth markedly where it is free to attack the black cherry. Insect control, combined with weeding, materially increased the height growth of cherry.

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RS-AL
SILVICULTURE
Harvest Cuttings

PROJECT STATUS SHEET

January 15, 1944

HARVEST CUTTINGS

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Harvest cuttings, beech-birch-maple-hemlock

PURPOSE:

To determine commercially feasible methods of harvesting timber that will prolong the cutting period, gradually increase the quality of timber, perpetuate desirable species, and return high total yields.

REVIEW OF PAST WORK:

Clear cutting of mature stands or second growth for either sawlogs or cordwood is undesirable forest practice from the standpoint of operator profits and future forest productivity. Heavy cutting on a 40-year cutting cycle gives better results than clear cutting but permanent forest industries prosper best when they practice light partial cutting of sawlogs on a 10 to 20 year cycle combined with stand improvement cutting of chemicalwood, pulpwood, or other small sized products. Both pulpwood and chemicalwood can be produced with less expenditure of labor by leaving trees smaller than 8" - 10" dbh or 6" - 8" dbh respectively, for future growth. Pole skidding is 20% faster than draying for skidding distances of 350 feet or less but slower than draying for distances greater than 600 feet.

ACCOMPLISHMENTS DURING PAST YEAR:

A study of mine prop production costs in the soft coal region of western Maryland was made in cooperation with the Maryland Department of Forests and Parks. The results show partial cutting to be the best method for handling young second growth mixed oak stands. Production per man is about the same as clear cutting but better quality props commanding higher prices make this the most profitable to the wood cutter and prop operator. The growing stock left after partial cutting will produce a new cut of props and some saw timber in 10 or 15 years.

PLANS FOR NEXT YEAR:

Studies of harvest cutting methods to be applied in second growth mine prop stands in the Anthracite Region and in older second growth sawlog stands in Pennsylvania and New York will be continued as time permits.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Hough.

RS-AL
SILVICULTURE
Harvest Cuttings

PROJECT STATUS SHEET

January 15, 1944

HARVEST CUTTINGS

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Harvest cuttings, oak-pine (New Jersey and Maryland)

PURPOSE:

To develop practical methods of harvesting oak-pine stands that will result in high yields of the most valuable products, and ensure adequate seedling reproduction with a high percentage of pine.

REVIEW OF PAST WORK:

In 1940, 56 plots were established in two types of South Jersey's oak-pine stands to test the use of seed tree cuttings followed by various types of brush disposal and soil scarification as methods of getting natural seedling reproduction of pine. Apparent seed crop failure caused 28 plots to be ineffective in their first year. Initial measurement of the other 28 plots showed up to 80% stocking by new seedlings, with 87% occurring on mineral soil. In 1941 a cutting experiment in 54-year-old loblolly pine was started to compare the economic returns and yield from harvesting piling and sawlogs on 5- and 10-year cutting cycles and with clear cutting. Logging costs were cheaper per M on a 25% cut than on either clear cutting or on a 10% cut; stumpage returns, highest per M on the clear cut area and lowest on the 25% cut, though differences were not important. Problem analyses were prepared for the oak-pine type in Maryland, Delaware, and in New Jersey.

ACCOMPLISHMENTS DURING PAST YEAR:

Completed progress report on the earlier study shows the importance of a mineral seedbed (15 times as many new seedlings per unit area as on litter) and the inadvisability of lopping and scattering slash (only 10% as many seedlings per unit area of slash seedbed as on litter). New seedlings in one year per acre of mineral soil ranged by blocks from 600 to 2500. There is some basis for assuming that in South Jersey 15 to 20 seed trees per acre may often be needed, and that mechanical treatments should be made in the fall.

PLANS FOR NEXT YEAR:

Complete report on loblolly pine cutting study.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Little, Schnur.

RS-AL
SILVICULTURE
Stand Improvement

PROJECT STATUS SHEET

January 15, 1944

STAND IMPROVEMENT

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Stand improvement, beech-birch-maple-hemlock

PURPOSE:

To determine the extent to which large areas of second growth northern hardwood forest can be improved in composition, growth rate, and quality by practical stand treatments.

REVIEW OF PAST WORK:

Heavy commercial cutting for cordwood products in young second growth stands results in an inferior understocked third growth subject to increased fire hazard, ice and wind breakage, sunscald, and increases the proportion of sprouts to seedlings. Studies of stand improvement methods indicate light partial cuttings to be best from the standpoint of the operator, the wood cutter, and forest volume growth both for cordwood and sawlogs. Cutting cycles are shortened and growth of the residual stand increases as much as 20% after the selective removal of 5 to 8 cords per acre in well-stocked stands on average sites. Weedings in stands under 20 years of age by the crop tree method were successful in stimulating growth of desirable trees but are not a panacea for poor harvest cutting practices.

Stand improvement cuttings in second growth are practical on a large scale and are being adopted by pulpwood and chemical wood companies in this region.

ACCOMPLISHMENTS DURING PAST YEAR:

Results of weeding studies begun in 1936 were submitted for publication in an article entitled "Early weeding in northern hardwoods". Partial cutting methods of management in second growth stands were outlined by Lyman and Ostrom in an article appearing in Forest Leaves under the title, "Keep them growing. Save time and timber while harvesting chemical wood".

PLANS FOR NEXT YEAR:

No new work is planned on this project during war period.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

None.

RS-AL
SILVICULTURE
Stand Improvement

PROJECT STATUS SHEET

January 15, 1944

STAND IMPROVEMENT

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Stand improvement, oak-pine type of Coastal Plain

PURPOSE:

To develop practical methods by which the composition, growth, and quality of immature stands can be improved.

REVIEW OF PAST WORK:

Dense, stagnant old-field Virginia pine should be thinned at about 10, 16, and 25 years of age, reducing stand to 700 trees per acre in last thinning. White pine 6 x 6 plantation should be thinned at 15 to 20 years of age; pruned before 25 years. Loblolly pine responds well to thinnings at 23 and 30 years of age, removing trees that would die within 10 to 15 years. Seed dispersal studies on isolated white-cedars show seed catch predominantly on northeast, east, or southeast side of trees. Best height growth of 2-0 planted cedars in hardwood swamps occurs when released from overwood and brush, averaging four times that of controls and double of best treatment average on St. Johns sites. Many bore mature cones at end of first field season. Light intensities of 1% to 2% of full sunlight in swamp control plots showed lowest stocking of seeded spots and smallest growth of seedlings as contrasted to clear-cut plots with light intensities of 75 to 80%. St. Johns sites must be scalped for seeding but not for planting.

ACCOMPLISHMENTS DURING PAST YEAR:

Reports of 2-year study on white-cedar seed dispersal and on conversion of hardwood and pine swamps to white-cedar were completed. The former shows that areas near isolated trees receive far more seed than those farther away; and though probably 60% falls at a distance beyond the tree's height, enough for adequate stocking is limited to distances equal to tree's height on west side and twice that on east side. Deer and rabbit damage on all areas was so heavy that desired second-year and future results from the latter study will not be obtained.

PLANS FOR NEXT YEAR:

Possibly remeasure the Virginia pine and white pine plots if time permits.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Little.

RS-AL
SILVICULTURE
Silvics

PROJECT STATUS SHEET

January 15, 1944

SILVICS

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Silvics, beech-birch-maple-hemlock

PURPOSE:

To determine the silvical characteristics of species and the ecology of stands, as the bases for silvicultural practices.

REVIEW OF PAST WORK:

Original major forest types of Allegheny High Plateaus are white pine-hemlock-hardwoods, hemlock-beech, and beech-sugar maple. Differences between types have been quantitatively defined. Second growth stands following logging and fire fall into (1) those containing white pine, and (2) those dominated by beech, maple, black cherry, and birch. Widespread losses are caused by heavy logging followed by fire and by wind storms, drought and sunscald, ice and snow damage. Frost pockets combined with damage by rabbits, deer, and other animals prevent development of new forests on local areas. Degree of logging and severity of past fires exert an important influence on the species composition of present day second growth. Life histories of stands show that white pine, hemlock, black cherry, white ash, yellowpoplar and basswood, as well as birch and red maple, become established after natural catastrophes such as windthrow, drought, or fire in old growth forests. Heavy logging increases the abundance of black cherry, red maple, and sweet birch; light cuttings favor tolerant sugar maple, beech, hemlock, and yellow birch. Though of relatively low commercial value, beech is one of the most ubiquitous species, reproduces and grows well and is desirable silviculturally. Ability to persist under suppression and rapid sustained growth after release are outstanding silvical characteristics of the tolerant species.

ACCOMPLISHMENTS DURING PAST YEAR:

Publication of three manuscripts dealing with the soil types and the silvics and ecology of forests on the Allegheny Plateau completed certain phases of this project. Old growth forests undisturbed by serious catastrophes for 300 to 500 years were shown capable of growing on three distinctly different soil types. In general the sub-climax white pine-hemlock forests were lower in silt-plus-clay content and in available chemical nutrients than those of the climax hemlock-beech or the beech-maple associations.

PLANS FOR NEXT YEAR:

Observations on the reproduction of other species after various degrees of thinning and harvest cutting will be made if war work permits.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Hough.

RS-AL
SILVICULTURE
Silvics

PROJECT STATUS SHEET

January 15, 1944

SILVICS

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Silvics, oak-pine

PURPOSE:

To determine, as the basis for silvicultural practices, the ecology of stands and the silvical characters of the principal species, including the effect of environmental factors on natural regeneration by seed or sprout.

REVIEW OF PAST WORK:

Seed production of oak; seed dispersal of pine and Atlantic white-cedar; the effect of site, animals, insects, and seedbed on reproduction in the oak-pine type; relation between leaf area and root system of sprouts and those of parent tree; vigor of sprouting by species of oak; and phenological observations, have been studied and reported in 18 technical notes and papers in various journals. As a basis for white-cedar management, a study of the lowland sites in southern New Jersey was initiated in 1940 to determine the successional stages and climax and the factors controlling succession. Mature white-cedar stands disperse some 8-1/2 million seeds per acre per year; shortleaf and pitch pine, 3,000 to 300,000.

Light measurements under various swamp stands show that near ground level, the following light intensities -- in terms of full sunlight -- exist: old cranberry bogs, 40%; hardwood and cedar reproduction, 8% to 20%; sapling-pole to mature cedar, or mixed stands, 4% to 7%; and hardwood sapling-pole or larger stands, generally 1% to 2%. Greenhouse experiment started using seedlings of three swamp species under three light intensities and three water table conditions.

ACCOMPLISHMENTS DURING PAST YEAR:

Completed report on successional study indicates fairly conclusively from age and stand composition data the temporary nature of the white-cedar stands and from other data white-cedar's silvical requirements. Analysis of greenhouse data shows that these supplement and strengthen field findings.

PLANS FOR NEXT YEAR:

Prepare report on greenhouse study.

DATE OF COMPLETION:

1944.

ASSIGNMENT:

Little.

RS-AL
SILVICULTURE
Silvics
Soils - fertilizers

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL STUDIES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Silvics, soils -- fertilizers

PURPOSE:

To test different fertilizer constituents, concentrations, and methods of application for the purpose of improving the growth and vigor of forest trees.

REVIEW OF PAST WORK:

A red and white pine plantation was given different fertilizer, sawdust-mulch, and scalping treatments. A review of tree fertilizing practices was begun.

ACCOMPLISHMENTS DURING PAST YEAR:

A cooperative project was undertaken with the Division of Soil and Fertilizer Investigations (BPISAE) to guide postwar use of fertilizers in forest practice. High level of nitrogen applied to red and white pines one year after planting stimulated grass competition and decreased survival during an unusually dry summer. A study of broadcast, worked-in, and hole methods of fertilizing was begun on a plantation of red spruce and red pine. Hole and broadcast methods were also employed in a fertilizer experiment involving white oak trees on the Beltsville Research Center grounds. Leaf samples from four fertilizer studies were collected for chemical analysis at the BPISAE.

PLANS FOR NEXT YEAR:

Existing studies will be maintained, including cooperation with BPISAE in chemical analyses of leaves of fertilized trees. A new study of tree fertilization will be initiated.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Maki, Ostrom, and C.P.S. Assistants.

RS-AL
SILVICULTURE
Silvics
Wound healing

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL STUDIES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Silvics, wound healing

PURPOSE:

To determine methods of hastening healing of tree wounds through use of fertilizers and wound dressings.

REVIEW OF PAST WORK:

As part of a cooperative project with the BPISAE at Beltsville Research Center, two major and several minor wound-healing studies were begun in the fall of 1942. The major studies were (1) a test of coating materials and growth regulators on 252 trees of 7 species, and (2) a test of fertilizers, coating materials, and growth regulators on white oak and pitch pine. Minor experiments concerned the relation between intensity of wounding on type of wound and rate of wound healing.

ACCOMPLISHMENTS DURING PAST YEAR:

Spring treatments were performed in the 2 major studies begun in 1942. Lanolin produced definitely better healing than shellac or no treatment, chiefly because it prevented drying out and dying back of the cambium at the wound margin. It also prevented drying and checking of the wood on the wound surface, occasionally permitting islands of callus to form there. In white oak broadcast fertilization with 375 lb. of N, 150 lbs. of P_2O_5, and 80 lbs. of K_2O per acre, applied around the base of wounded trees, increased wound healing by 66%. High level of P and K, with or without N, stimulated wound healing of pitch pine by 15%. Growth regulator treatments tried were usually harmful, but in one test they improved the rate of healing of pitch pine wounded in the fall.

PLANS FOR NEXT YEAR:

Existing experiments will be followed up, chemical analyses will be made of leaves of fertilized trees, and small-scale further tests will be carried out.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Forest Service: Maki, McQuilkin, Ostrom, and C.P.S. Assistants.
Bureau of Plant Industry: Hamner.

RS-AL
MENSURATION
Stand Studies
(ME-2)

PROJECT STATUS SHEET

January 15, 1944

Stand Development, Growth and Yield

FIELD DIVISION: Forest Management

WORK PROJECT: Mensuration

LINE PROJECT: Stand study - spruce and fir growth and yield

PURPOSE:

To prepare normal yield tables for even-aged second growth stands of red spruce, pure and in mixture with other spruces and balsam fir; to determine the approach to normality of understocked stands; to provide a basis for prediction of spruce-fir yields on cut-over lands; and prepare yield tables which will be applicable over the entire spruce region of the Northeast.

REVIEW OF PAST WORK:

U.S.D.A. Bulletin No. 142 was published in 1929 giving tables of yield for fully stocked, even-aged, second growth stands of spruce and fir. To check these tables and provide information on mortality, change in composition and rate at which understocked stands approach normality, 18 sample plots are being maintained in New Hampshire and Vermont. A special analysis of growth in northern Vermont and New Hampshire was made in 1936 for the Coos-Essex cooperative sustained yield project. Data from 365 plots on cut-over lands have been analyzed statistically to derive a mathematical expression of spruce-fir volume on cut-over lands as a function of time since cutting, density (as indicated by the relation between number of trees and their average diameter), and composition (as indicated by the proportion of the total number of trees represented by spruce and fir).

ACCOMPLISHMENTS DURING PAST YEAR:

The first draft of a manuscript covering the development and application phases of the yield table has been completed.

PLANS FOR NEXT YEAR:

The scope of the manuscript is being broadened to include a discussion of the significance of the current and potential growth in the spruce-fir region to consumption trends and the bearing of these factors on the success of the pulpwood industry in the region.

DATE OF COMPLETION:

Early in 1944.

ASSIGNMENT:

Westveld.

RS-AL
REGENERATION
Planting

PROJECT STATUS SHEET

January 15, 1944

FOREST PLANTING

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Planting (oak pine and northern hardwoods)

PURPOSE:

To devise planting techniques insuring high survival, rapid growth, and best quality of plantations.

REVIEW OF PAST WORK:

Preliminary results published on interplanting conifers in southern New Jersey oak coppice. Species best adapted to various types indicating study of several hundred three- to ten-year-old plantations. Planting methods and species adaptation tests started in 1938. Published suggestions for improved methods of shipping, heeling-in and handling older plantations in northwestern Pennsylvania in cooperation with Department of Forests and Waters. Test plantings indicate black locust most successful on dry, difficult sites subject to grazing. Grading planting stock, using only largest trees, results in less damage by frost heaving and better survival and height growth, and in the case of hardwoods less damage by frost. White spruce planted under a light cover of aspen and pin cherry grow faster than those planted in the open.

ACCOMPLISHMENTS DURING PAST YEAR:

Completed short report on New Jersey interplanting emphasizes importance of competition on growth of planted stock. Average annual height growth for native pines was 58 to 100% (0.5-0.6') greater on open areas than in small openings of oak-pine stand. Periodic clearcutting of oak sprouts is apparently most economical and advantageous.

PLANS FOR NEXT YEAR:

None for New Jersey. Preparation of technical notes on northwestern Pennsylvania test plantations.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Hough and Little.

RS-AL
REGENERATION
Planting

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL STUDIES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Planting practices

PURPOSE:

To develop planting and seeding techniques and methods of site preparation that will insure successful restocking of eroded old fields and other difficult sites.

REVIEW OF PAST WORK:

A direct seeding on an abandoned old field showed that 40% of loblolly, shortleaf, and pitch pine seedlings were frost-heaved at the end of the first winter following germination, while essentially no frost heaving of southern red oak occurred. A study was initiated on mulching and fertilizing of black locust and red pine at planting time.

ACCOMPLISHMENTS DURING THE PAST YEAR:

A mulch of pine needles or of broomsedge increased survival of black locust and red pine by 50%, resulting in marked reduction of frost heaving. Surface application of an NPK fertilizer at the rate of 300 lbs. N, 400 lbs. P_2O_5, and 200 lbs. K_2O (equivalent to 45.8 gms. or 1.6 ozs. of total salts per tree) increased survival of black locust on unmulched rows but caused no difference in the mulched rows. Fertilizers tended to decrease first year survival and growth of red pine, but strikingly increased growth of black locust. An experiment on the use of fertilizers and mulches for stabilizing raw soil, and another experiment on fertilizing and rye cover crops as site preparation measures prior to seeding and planting were initiated in October-December 1943. Cooperative work with the State Forester of Pennsylvania undertaken on Anthracite Region stripping bank revegetation.

PLANS FOR NEXT YEAR:

Follow up on all site preparation and planting-seeding, fertilizing series. Undertake preliminary tests of stripping bank revegetation in the Anthracite Region.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

McQuilkin, Ostrom, Maki, and C.P.S. Assistants.

RS-AL
REGENERATION
Planting

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL RESEARCH

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Planting, large transplants

PURPOSE:

To improve the survival and growth of large transplants by treatment with growth regulators, protective coatings, and nutrients.

REVIEW OF PAST WORK:

An experimental transplanting of 4 species, variously treated with naphthalene acetic acid at the time of moving, was done in August 1942, in cooperation with the BPISAE.

ACCOMPLISHMENTS DURING PAST YEAR:

Observations were continued on the 1942 planting. Red spruce and white pine saplings (112 of each) were transplanted bare-rooted in late March 1943, with various root- and top-spray treatments involving mixtures of lanolin or Dowax and growth regulators. Scarlet oak and Austrian pine saplings (480 of each) were treated in the nursery during the winter prior to transplanting in June 1943, the treatments being various combinations of growth regulators and high K-fertilizer, with and without root pruning, both balled and bare-root moving. None of the growth regulator treatments in any of the experiments has been beneficial. Successful moving of sapling stock during the growing season, by use of nothing more than good planting technique, has been demonstrated by the 1942 plantings. Balling was helpful, but not essential to success. Quick feeding (preconditioning) with high K-fertilizer markedly improved performance of both species in the June 1943 plantings.

PLANS FOR NEXT YEAR:

Complete observations and prepare a short article for publication on the above studies. Start a small scale follow-up study of quick feeding for sapling stock.

DATE OF COMPLETION:

Current studies, 1944. Projected follow-up study, 1945.

ASSIGNMENT:

Forest Service: McQuilkin, Maki, and C.P.S. Assistants.
Bureau of Plant Industry: Hamner, Marth.

RS-AL
REGENERATION
Planting

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL STUDIES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Planting, small stock treatments

PURPOSE:

To control top and root development and improve drought hardiness of forest planting stock through treatment with plant growth regulators and protective foliage coatings.

REVIEW OF PAST WORK:

Treatment of 21 tree and 6 shrub species with indolebutyric acid showed root stimulation in some cases. Top treatment caused alteration of character and timing of shoot growth of pines.

ACCOMPLISHMENTS DURING PAST YEAR:

A series of studies was conducted in cooperation with the Hormone Project, BPISAE, and the Maryland State Forest Nursery at College Park. Over-development of held-over pine stock in nursery beds was largely prevented by a top spray of naphthalene acetic acid. Vapor and spray treatments with naphthalene compounds were found effective in preventing shoot development of hardwood stock in common storage and in improving survival of hardwoods after late planting. Top inhibition with growth regulators before planting did not improve field survival or drought hardiness of pine seedlings, and was often harmful. Foliage sprays of lanolin or commercial wax emulsion usually improved field survival of conifers by 10 percent.

PLANS FOR NEXT YEAR:

Further tests will be made to determine best concentrations of growth regulators for stimulating roots and prolonging top dormancy. Winter and spring tests of foliage coatings will be conducted.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Forest Service: Ostrom and C.P.S. Assistants.
Bureau of Plant Industry: Hamner and Marth.

RS-AL
REGENERATION
Planting

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL STUDIES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Planting, stock storage

PURPOSE:

To lengthen the time planting stock may be successfully stored prior to out-planting.

REVIEW OF PAST WORK:

A test of the effects of length of warm storage (70° F.) on red and white pine showed that there were no significant differences in field survival of stock stored 4, 11, or 21 days, but that all stored stock was significantly poorer than unstored controls.

ACCOMPLISHMENTS DURING PAST YEAR:

Several studies involving pre-storage treatment of planting stock with growth regulators and protective coatings were conducted in cooperation with the BPISAE. Vapor and spray applications of naphthalene methyl-acetate and several other compounds effectively prevented development of etiolated shoots on white ash held in common storage for late planting, and increased initial field survival of the same stock. Similar treatments of coniferous stock did not prolong dormancy and were often injurious. Lanolin coatings on tops or tops and roots of several pine species slightly reduced deterioration of the stock during long storage periods. A commercial wax caused molding in storage and was injurious to pitch pine. Prolongation of dormancy by control of winter storage temperature is being studied on a small scale. A study of the value of protective coatings for over-winter heeling-in of pine seedlings was begun.

PLANS FOR NEXT YEAR:

The storage-temperature-control and heeling-in studies will be continued and a further test of pre-storage treatment with growth regulators will be conducted.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Forest Service: Ostrom, Maki, and C.P.S. Assistants.
Bureau of Plant Industry: Hamner and Marth.

RS-AL
REGENERATION
Nursery Studies
Seedbeds

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL STUDIES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Nursery, seedbed mulches

PURPOSE:

To determine the effect on germinating seed of chemicals used to preserve cloth seedbed mulches.

REVIEW OF PAST WORK:

Mulching cloth treated with 10 different preservative chemicals in a cooperative study with the Bureau of Human Nutrition and Home Economics was tested on seedbeds in 5 different nurseries. A study of organic mulches and soil amendments in conifer and hardwood beds was installed.

ACCOMPLISHMENTS DURING PAST YEAR:

Of the cloth preservative chemicals, cadmium chloride causes nearly complete mortality of pine and oak seedlings. No other chemicals used were toxic. Breaking-strength tests showed that lead acetate-potassium dichromate treatment of mulch cloth distinctly improved its resistance to weathering. One commercial preservative was also quite effective.

Cloth seedbed mulch tended to give slightly better results than sawdust, pine litter, or hardwood litter. There was no consistent difference between germination on beds covered with the three organic mulches.

PLANS FOR NEXT YEAR:

Continue test of mulch cloths treated with preservative chemicals.

DATE OF COMPLETION:

Preservative phase -- 1946; others -- 1944.

ASSIGNMENT:

Forest Service: McQuilkin, C.P.S. Assistants.
Bureau of Human Nutrition and Home Economics: Furry.

RS-AL
REGENERATION
Seed Studies

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL STUDIES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Seed investigations

PURPOSE:

To develop better seed testing, treating and handling practices, and to determine effect of seed maturity and seed source on seed quality and seedling hardiness.

REVIEW OF PAST WORK:

Seed of loblolly, shortleaf, and pitch pines, yellowpoplar, and southern red oak collected from several sources and tested for quality; nursery sowings of sources made in fall of 1941. Preliminary tests made on flotation technique for separating empty and blind seed from sound seed.

ACCOMPLISHMENTS DURING THE PAST YEAR:

Flotation technique tested on several conifers. A study of lanolin and shellac coatings, with and without growth regulators, on oak acorns indicated possibilities of using these substances for preventing desiccation and reducing germination in over-winter storage. Initial test of several penetrants for improving imbibition of refractory seed did not show much promise. Suitable over-winter methods of storage worked out for scarlet oak and eastern red oak. A study of white oak acorn storage employing several protective coatings and growth regulators was undertaken in cooperation with the Photoperiod and Hormone Project, BPISAE.

PLANS FOR NEXT YEAR:

Follow up previous coating studies and new acorn storage study. Initiate study on seed density, nutrient coatings, and additional tests on seed sources and imbibition. Prepare reports on flotation and on seed sources and complete problem analysis on forest tree seed.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Maki, McQuilkin, and C.P.S. Assistants.

RS-AL
REGENERATION
Nursery Studies

PROJECT STATUS SHEET

January 15, 1944

FOREST MANAGEMENT, FUNDAMENTAL STUDIES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Nursery studies, seedling nutrition

PURPOSE:

To determine the nutritional requirements of tree seedlings, with special reference to nursery practice.

REVIEW OF PAST WORK:

New project.

ACCOMPLISHMENTS DURING PAST YEAR:

In a preliminary test of techniques, tuliptree, red pine, and red spruce seedlings were given 11 different nutritional regimes in sand cultures replenished at weekly intervals, and in a sand-peat mixture receiving one initial application of solid fertilizer in the spring. Survival and top growth were better in the sand series, but root growth was better in the sand-peat series. Leaf samples of tuliptree were collected for analysis, and seedling weights and volumes were measured.

PLANS FOR NEXT YEAR:

Seedling measurements will be analyzed, and chemical analyses of leaves will be conducted with the aid of facilities at the Division of Soil and Fertilizer Investigations, BPISAE. A new study involving combinations of nutrients and watering schedules will be undertaken in the spring of 1944.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Ostrom, Maki, and C.P.S. Assistants.

RS-AL
GENETICS
Racial Variation

PROJECT STATUS SHEET

January 15, 1944

RACIAL VARIATION

FIELD DIVISION: Forest Management Research

WORK PROJECT: Forest Genetics

LINE PROJECT: Racial Variation -- seed source investigation

PURPOSE:

To determine the effect of geographic origin, seed density, and degree of seed maturity, on seed quality, drought hardiness of seedlings, and general utility of strain for forest planting in the Allegheny territory.

REVIEW OF PAST WORK:

Red pine transplants from 50 seed sources in 9 climatic regions from New England to the Lake States were planted in 1937 at Kane, Pa. Seed of pine from several localities was collected at different stages of maturity and sown in an experimental nursery for subsequent tests of drought hardiness. Special tests of the relationship between seed density and seedling vigor were undertaken. Cooperative tests on red and white pine from Ontario showed no difference due to seed source after 3 years' growth. Fourteen seed lots of Norway spruce of various European origins showed racial differences at the end of the second year.

ACCOMPLISHMENTS DURING PAST YEAR:

Drought hardiness of loblolly and shortleaf pine seedlings was found to be associated with origin of seed. Loblolly stock from North Carolina seed gave 65% survival during the severe summer of 1943 as contrasted with 83% for stock from Maryland seed. Shortleaf pine stock from Durham, North Carolina seed gave 55% survival, that from Asheville, North Carolina, 79%. Wide variation in drought resistance of loblolly pine was also associated with the individual parent trees from which the seed was collected.

PLANS FOR NEXT YEAR:

Further tests and observations will be made on stock already on hand.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Maki, Schreiner, and Hough.

RS-AL
GENETICS
Racial Variation

PROJECT STATUS SHEET

January 15, 1944

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FIELD DIVISION: Forest Management Research

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PLANS FOR NEXT YEAR:

Further tests and observations will be made on stock already on hand.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Maki, Schreiner, and Hough.

RS-AL
GENETICS
Racial Variation

PROJECT STATUS SHEET

January 15, 1944

INDIVIDUAL VARIATION

FIELD DIVISION: Forest Management Research

WORK PROJECT: Forest Genetics

LINE PROJECT: Variation in resistance to inhibiting effect of sod

PURPOSE:

To investigate the extent of inherent variation in growth inhibition of forest species and particularly to discover the best trees for planting in sod.

REVIEW OF PAST WORK:

Field tests with hybrid poplars indicate statistically significant differences in survival and growth on grass land between hybrids having one parent in common.

ACCOMPLISHMENTS DURING PAST YEAR:

Greenhouse experiments with hybrid poplars show that the inhibiting effect of grass is probably more than competition for water and nutrients. These experiments also provide a possible quick method for testing the reaction of individual trees to the inhibiting effect of grass.

PLANS FOR NEXT YEAR:

Greenhouse studies will be continued to develop a method for rapidly testing the inherent reaction to grass.

DATE OF COMPLETION:

Indefinite, but can be discontinued at the end of any season.

ASSIGNMENT:

Schreiner.

RS-AL
GENETICS
Breeding

PROJECT STATUS SHEET

January 15, 1944

FIELD TESTS - NEW HYBRID POPLARS

FIELD DIVISION: Forest Management Research

WORK PROJECT: Forest Genetics

LINE PROJECT: Breeding -- Oxford hybrid poplars

PURPOSE:

To determine for various sections in the United States the suitability of the Oxford hybrid poplars for forest planting.

REVIEW OF PAST WORK:

Cuttings of 58 selected hybrid clones have been distributed to 25 cooperating Forest Service, Soil Conservation Service, Bureau of Plant Industry, and state nurseries throughout the United States. Cuttings have also been sent to government agencies in South America. It is apparent from these cooperative nursery tests that the growth and development of a hybrid in any particular region cannot be predicted but must be based upon actual field tests in that region.

ACCOMPLISHMENTS DURING PAST YEAR:

There was only limited opportunity for distribution of additional cuttings. Dr. Schramm, University of Pennsylvania, included cuttings in his experimental plantings on anthracite sludge and refuse banks.

PLANS FOR NEXT YEAR:

No specific work planned. Requests for cuttings in small numbers will be complied with if possible.

DATE OF COMPLETION:

Final conclusions should be based on data from 10- to 15-year-old plantations.

ASSIGNMENT:

Schreiner.

RS-AL
GENETICS
Breeding

PROJECT STATUS SHEET

January 15, 1944

BREEDING AND INHERITANCE - FOREST TREES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Forest Genetics

LINE PROJECT: Breeding and inheritance

PURPOSE:

Controlled breeding for the production of improved forest trees and for information on inheritance in forest tree species.

REVIEW OF PAST WORK:

A total of 21,600 seedlings resulting from controlled pollinations on Acer, Betula, Fagus, Fraxinus, Liquidambar, Liriodendron, Magnolia, Picea, Pinus, Populus, Quercus, Tilia, Tsuga, and Ulmus were grown at the Hopkins Memorial Forest until the fall of 1942. The breeding work has produced evidence for the occurrence of dichogamy in many forest species and self-incompatability in individual trees. In Betula species, some viable seed is produced without pollination (apomixis).

The F_2 Populus hybrids (some 6-species hybrids) produced in 1941 and 1942 show wide morphological and physiological variation.

Close pollination on three species of Ulmus have indicated some degree of self-fertility without appreciable loss of vigor.

ACCOMPLISHMENTS DURING PAST YEAR:

All nursery stock was moved from Williamstown, Massachusetts during the winter of 1942-43 and planted at Beltsville, Maryland. The severe drought during July and August resulted in heavy losses to the out-planted stock but very little loss to nursery stock.

PLANS FOR NEXT YEAR:

No controlled breeding work is planned for 1944. This line project will be limited to maintenance and summarization (for publication) of breeding results to date.

DATE OF COMPLETION:

Controlled breeding should be continued when conditions permit.

ASSIGNMENT:

Schreiner.

RS-AL
GENETICS
Physiology

PROJECT STATUS SHEET

January 15, 1944

PHYSIOLOGY - CLONAL PROPAGATION OF FOREST TREES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Forest Genetics

LINE PROJECT: Clonal propagation

PURPOSE:

To develop economically feasible methods for clonal propagation of important forest tree types.

REVIEW OF PAST WORK:

The following factors have been found to exert a considerable influence on the rooting of cuttings of forest tree species: (1) optimum auxin treatment; (2) type of outdoor propagating bed; (3) age and position on tree from which cuttings are taken; and (4) clonal variation, ranging from 18 to 98% for red maple. Optimum conditions and treatments have resulted in the following rooting percentages: Sugar maple, 80%; red maple, 70%; aspen, 60%; white birch, 50%; basswood, 25%; and white pine, 50%. The variation in rooting ability of 16 red maple clones (one-half male and one-half female) was from 8% to 94%; the males rooting to a greater extent, on an average, than the females. By growing sugar maple cuttings in sash beds with horse manure below the rooting medium greenwood cuttings from old trees (60+ years) were rooted up to about 40% for cuttings of a current season's growth only, and 20% when older wood was at the base. Experiments with red maple indicate that in this species rooting is inversely correlated with fruitfulness.

ACCOMPLISHMENTS DURING PAST YEAR:

Exploratory work with oak resulted in heavy losses due to bacterial plugging of the conducting tissue in the cuttings.

PLANS FOR NEXT YEAR:

Exploratory work to determine a possible attack on the problem of stem rot and bacterial injury to cuttings.

DATE OF COMPLETION:

Completed for the duration unless special need arises.

ASSIGNMENT:

Schreiner.

RS-AL
FIRE
Effects

PROJECT STATUS SHEET

January 15, 1944

EFFECTS OF FIRE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Forest fire protection

LINE PROJECT: Effects

PURPOSE:

To determine the effects of fire on the tree, the forest, and the site, including effects of controlled fires on seedbed conditions and species composition, as a basis for formulating sound silvicultural and fire protection policies and plans.

REVIEW OF PAST WORK:

Comparative fire resistance determined for six important tree species, in 1930. Fire damage to standing trees from controlled burning was found to be reduced by use of the safety-strip method of pretreatment. In cooperation with the State of New Jersey, a revised method of fire damage appraisal was worked out; an 80-acre controlled burning experiment was begun in 1936-37, and a 14-acre one in 1940. Even with annual burns over a 5-year period mortality among pitch and shortleaf pines 0.6" or larger at the time of the first burn was negligible. The amount of pine seedling reproduction was reduced on all areas having more than one burn in that period, particularly in the taller height classes. Areas having only one burn showed a net increase of approximately 400 seedlings per acre, although having much the same reductions in taller height classes.

A study of deterioration of fire-killed pine was started after the serious fire of April 20, 1941, on the Eastern Shore Forest. Loblolly and pond pine killed by a spring fire were unsuitable for sawlogs within six months due to damage from flathead borers. At twelve months the wood was still suitable for pulpwood when thoroughly dried, but charred knots were abundant and difficult to remove entirely.

ACCOMPLISHMENTS DURING PAST YEAR:

New Jersey plots maintained; working plan for 14-acre experiment revised.

PLANS FOR NEXT YEAR:

Maintain plot treatments in New Jersey as scheduled. Prepare paper on results to date in New Jersey.

DATE OF COMPLETION:

1952 for both studies in New Jersey. Loblolly pine study completed.

ASSIGNMENT:

Little.

RP-AL PROJECT STATUS SHEET
TIMBER CONVERSION
Fuelwood Utilization January 15, 1944

FUELWOOD UTILIZATION

FIELD DIVISION: Forest Products Research

WORK PROJECT: Timber Harvesting and Conversion

LINE PROJECT: Fuelwood Utilization

PURPOSE:

To test uses and more efficient harvesting methods for small-sized and low grade trees in southern New England.

REVIEW OF PAST WORK:

Tests run on performance of coal boiler in Connecticut state institution as basis for comparison with hogged wood and time studies of hogged wood production completed and published. Published results of tests on charwood heaters, explored use of wood gas, and cooperated in design and building of portable charcoal kilns. Preliminary time studies made on use of tools, equipment, and methods of crew organization for fuelwood production. Designed and tested equipment for hauling packaged fuelwood. Determined that best method is to fell trees up to 12" d.b.h. with axe and pulp saw and use axe and two-man crosscut saw for larger trees, limbing and marking with axe. Buck within same diameter limits with same tools used in felling. Split with straight wedges and Oregon splitting maul. Pile only on sled when yarding. Bucking, splitting, and piling should be done in a yard or at the roadside when possible. Determined winter seasoning of cordwood not efficient. Obtained cost of production and yield on two 90-cord stationary charcoal kilns.

ACCOMPLISHMENTS DURING PAST YEAR:

After three years' failure to get equipment installed finally ran tests of burning hogged wood at state institution. Equipment not perfected for continued use. Combustion tests and comparison with coal as fuel in process of compilation. Began new attack on reducing cost of harvesting fuelwood with labor made available by state. Cooperated in attempt at further improvement of charwood heater.

PLANS FOR NEXT YEAR:

Continue tests of reducing harvesting costs by means of power equipment and modifications of methods of cutting.

DATE OF COMPLETION:

Indefinite.

ASSIGNMENT:

Cunningham, in cooperation with state agencies in Connecticut.

RE-AL
FOREST COOPERATIVES
Cooperstown

PROJECT STATUS SHEET

January 15, 1944

COOPERATIVE MANAGEMENT AND MARKETING FOR FARM WOODLANDS

FIELD DIVISION: Forest Economics Research
WORK PROJECT: Forest Cooperatives
LINE PROJECT: Cooperative management and marketing for farm woodlands

PURPOSE: To define and seek solutions for the problems inherent in the cooperative management of farm woodlands, and the cooperative marketing and processing of forest products.

REVIEW OF PAST WORK: In 1935, information was assembled on woodland areas and volume in the vicinity of Cooperstown, New York and local people assisted to organize the Otsego Forest Products Cooperative Association, helped to obtain loans from the Farm Security Administration, advised on by-laws and on constructing a modern sawmill, and provided a timber marking and growing-stock control service. Studies were made of log procurement techniques and of lumber grade and hardwood dimension recovery. A Rapid Reconnaissance System was devised for estimating timber and determining allowable cut. The place of the farm woodland in the farm management program on 90 member farms was studied in cooperation with the Bureau of Agricultural Economics, and a report prepared for distribution. During the latter half of 1942, the records of the more than 900 members were revised and checked and working plans developed for cost and return, volume and value, and grade realization studies, and a system of weekly reports on status of OFPCA inaugurated.

ACCOMPLISHMENTS DURING PAST YEAR: Comprehensive analyses of resource available from members and prospective members, together with studies of personnel organization and operating experience led to recommendations for economies which were adopted with considerable success by OFPCA. Regular weekly reports were maintained; monthly statements were simplified. Historical survey showing growth in membership, merchantable area, inventory volume, contracts, and deliveries completed; survey of financial history initiated. Merchantable timber stands within 25 miles hauling distance of mill were mapped from aerial photos; about 10% of the non-member owners were interviewed to determine their reactions to OFPCA membership. Studies of log grade realization, tree value, hauling costs, and stumpage and labor returns initiated. Fuelwood cutting demonstration plot established.

PLANS FOR NEXT YEAR: Inventory and marking services for members will be continued, and the Association assisted in solving membership, log procurement, and operating problems. Interviews of non-member owners of merchantable timber tracts will be continued and a preliminary report on results made; the log grade realization and stumpage and labor returns studies will be completed and reports issued; studies of felling, bucking, and skidding will be initiated; the survey of financial history will be finished; demonstration plots for sawlog cutting will be established.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Ineson, Bratton, Ferguson, C.P.S. Assistants.

RE-AL
SOCIAL BENEFITS
Anthracite Region

PROJECT STATUS SHEET

January 15, 1944

FOREST EMPLOYMENT POSSIBILITIES, ANTHRACITE REGION

FIELD DIVISION: Forest Economics Research

WORK PROJECT: Private Forestry

LINE PROJECT: Social Aspects

PURPOSE:

To determine the extent and character of the forest resources of the Anthracite Region and their potential contribution to employment.

REVIEW OF PAST WORK:

In cooperation with R-7 possibilities of improving fire protection through construction of improvements and otherwise reported. Report on tax delinquency of forest land published and Luzerne County aided in evaluating tax delinquent land. Forest resource inventory completed for six counties; compilations completed for Luzerne County; preliminary compilations completed for four additional counties. Weight-volume conversion tables compiled and report published on volume tables of commercial timber species. Land use maps prepared for nine counties. A comprehensive report and short pictorial report prepared for Luzerne County. Mine timber requirements data compiled for the region; growth data collected and analyzed for the northern counties and drain data obtained for Luzerne and Lackawanna Counties. Forest survey technique simplified and the use of aerial photographs in preparing forest condition maps and in making volume estimates explored.

ACCOMPLISHMENTS DURING PAST YEAR:

A comprehensive report on Luzerne County published; forest resource inventory completed in all of the remaining nine counties and preliminary forest area and volume data compiled and mimeographed for eleven counties; growth data compiled and analyzed for southern counties. Land use maps prepared for remaining six counties and forest condition maps completed for two counties; preliminary work facilitating the preparation of forest condition maps for six additional counties finished; forest types mapped for about one-half the region. The technique of using aerial photographs in forest survey further developed.

PLANS FOR NEXT YEAR:

Publish reports on the availability of mine timber and other forest resources; compile drain data for remaining counties; assemble material for comprehensive report on the forest resources of the Anthracite Region, the potential employment in forest rehabilitation in the immediate post-war period, and the ultimate possible employment in forest industries.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Ineson, Farree, C.P.S. Assistants.

ALLEGHENY FOREST EXPERIMENT STATION

PUBLICATIONS - 1943

Printed

Hough, A. F.	Norway spruce for pulpwood. Journal of Forestry 41(1): 66-68.
....	Soil factors and stand history in a virgin forest on the Northern Allegheny Plateau. Soil Science 56(1): 19-28.
....	Methods of harvesting sawtimber from forests in the High Plateaus section of Pennsylvania. Journal of Forestry 41(12): 898-903.
.... and R. D. Forbes	The ecology and silvics of forests in the High Plateaus section of Pennsylvania. Ecological Monographs 13:299-320.
Huberman, M. A.	Sunscald of eastern white pine. Ecology 24(4): 456-471.
Jensen, Victor S.	Suggestions for management of northern hardwood stands in the Northeast. Journal of Forestry 41(3): 180-185.
Lyman, Robert R. and Carl E. Ostrom	Keep them growing. Save time and timber while harvesting chemical wood. Forest Leaves 33 (2 and 3): 3, 10-13, 16.
Recknagel, A. B. and M. Westveld	How cutting affects forest growth. Pulp and Paper Magazine of Canada 43(13):966-968.
Shirley, Hardy L.	Is tolerance the capacity to endure shade? Journal of Forestry 41(5): 339-345.
....	Luzerne County looks at her forests. Forest Leaves 32(6): 1-2, 11.
....	Opportunities in forestry. Journal of Forestry 41(2): 83-86.
....	Forestry in the postwar world. Forest Leaves 33(2 and 3): 5-9.
....	Research at the Allegheny Forest Experiment Station. Proceedings, Pennsylvania Academy of Science 17: 90-94.

Taylor, R. F.	Production efficiency -- with a gap. The Plan. 23(3): 36.
Westveld, M.	Review, "Legend for Society of American Foresters forest cover types for the eastern United States", by L. H. Reineke. Northeastern Forest Expt. Sta. Occasional Paper 13. 12 pp. Journal of Forestry 41(3): 219.
....	Review, "Timbers of the world", by S. J. Record and R. W. Hess. Library News 3(14): November 1943.

Multilithed and Mimeographed

Forbes, R. D. and Clement Mesavage	The forests of Luzerne County, Pennsylvania, in relation to employment and welfare. Anthracite Survey Paper No. 5. 21 pp.
Ostrom, Carl E. and Miles J. Ferree	Species and sizes of stock for planting in northwestern Pennsylvania. Tech. Note No. 37.
Schnur, G. Luther	Lumber production 1942 - New England. Tech. Note No. 39.
Staff, Allegheny Forest Experiment Station (A.F.Hough)	Tionesta natural and scenic area, Allegheny National Forest. 10 pp. illus. maps.
Staff, Allegheny Forest Experiment Station (G.L.Schnur)	Preliminary estimate of lumber production 1942. Middle Atlantic States. Tech. Note No. 41.
Taylor, R. F. and G. Luther Schnur	Wartime work of the Allegheny Forest Experiment Station. Tech. Note No. 42.
Trimble, G. R.	Portable power saws can speed up cordwood production. Tech. Note No. 38.
.... and A. W. Bratton	Summer seasoned fuelwood best. Tech. Note No. 40.

PERSONNEL - 1943

Overhead Administration

Hardy L. Shirley, Director

Hazel L. Stiles, Jr. Administrative Asst.
Margaret R. Evans, Sr. Clerk
Katherine F. McKeaney, Sr. Stenographer
Josephine Sorrentino, Jr. Clerk Stenographer
Marjorie T. Jackson, Jr. Clerk Stenographer (SST 3/31/43)

Field Divisions

Bartlett Experimental Forest, Bartlett, New Hampshire
(In custody of the White Mountain National Forest)

Beltsville Experimental Forest and Laboratory, Laurel, Maryland
T. Ewald Maki, Sr. Forester

Chenango Experimental Forest, Smyrna, New York (Closed)

Eastern Shore Experimental Forest, Parsonsburg, Maryland
Silas Little, Jr., Assoc. Silviculturist

Finch-Pruyn Experimental Forest, Newcomb, New York (Closed)

Gale River Experimental Forest, Pierce Bridge, New Hampshire
(In custody of White Mountain National Forest)

Kane Experimental Forest, Kane, Pennsylvania
Ashbel F. Hough, Associate Silviculturist

Lawrence Hopkins Memorial Experimental Forest, Williamstown, Mass.
(Closed)

Lebanon Experimental Forest, New Lisbon, New Jersey
Silas Little, Jr., Assoc. Silviculturist

Massabesic Experimental Forest, Alfred, Maine (Closed)

Standing Stone Experimental Forest, Manor Hill, Pennsylvania
Ronald A. Bartoo, Agent (Military Service 4/19/43)
Professor H. Norton Cope, Collaborator (Appt. 12/16/43)

Cooperstown Forest Cooperative, Cooperstown, New York
Allen W. Bratton, Assoc. Forest Economist

Anthracite Forest Survey, Wilkes-Barre, Pennsylvania
Miles J. Ferree, Jr. Forester

Farm Forestry, Pine Meadow, Connecticut
Frank E. Cunningham, Asst. Forester

Work Projects

Forest Management

Raymond F. Taylor, Prin. Silviculturist, In Charge
Marian M. Thomas, Clerk Stenographer

Northern Hardwoods
Marinus Westveld, Sr. Silviculturist, In Charge
Ashbel F. Hough, Assoc. Silviculturist
Edwin H. Weil, Jr. Agricultural Aid (Appt. 12/1/43)

Oak
Dr. H. Arthur Meyer, Collaborator (SST 12/16/43)
Professor H. Norton Cope, Collaborator (Appt. 12/16/43)
Ronald A. Bartoo, Agent (Military Service 4/19/43)

Oak-pine
Silas Little, Jr., Assoc. Silviculturist
Horace A. Somes, Agricultural Aid (Military Service 8/24/43)

Genetics
Ernst J. Schreiner, Sr. Silviculturist
Harold F. Ford, Agricultural Aid (6 months)

Regeneration and Camouflage
(Hardy L. Shirley, In Charge)
T. Ewald Maki, Sr. Forester
William E. McQuilkin, Assoc. Silviculturist
Carl E. Ostrom, Assoc. Silviculturist
Ralph P. Broomall, Jr. Agricultural Aid
CPS Camp

Forest Economics

Frank A. Ineson, Sr. Forest Economist, In Charge
Florence Aronson, Sr. Stenographer

Cooperstown Forest Cooperative
Allen W. Bratton, Assoc. Forest Economist
Beatrice F. Kellogg, Asst. Clerk Stenographer (SST 7/30/43)
Roland H. Ferguson, Asst. Forester
C. Thornton Brown, Agricultural Aid (SST 7/24/43)
CPS Camp #12

Anthracite Forest Survey
Bertram C. Goodell, Asst. Forester (Trans. 8/27/43)
Miles J. Ferree, Jr. Forester
Stanley E. Filip (1 month)

Farm Forestry

(Raymond F. Taylor, Prin. Silviculturist, In Charge)
George R. Trimble, Jr., Asst. Forester (Trans. 7/4/43)
Frank E. Cunningham, Asst. Forester

Products Supplies and Requirements

(Raymond F. Taylor, Prin. Silviculturist, In Charge)
Lillian E. Taylor, Sr. Clerk (SST 9/16/43)
Emma L. Warfield, Jr. Statistical Clerk
Emily Lucille Knoll, Jr. Statistical Clerk (SST 3/9/43)

Pennsylvania, New Jersey, Delaware, and Maryland
G. Luther Schnur, Forester
Earl J. Rogers, Asst. Forester (Trans. 3/28/43)
Thomas E. Kendig, Jr. Forester (SST 10/27/43)
Harold F. Ford, Sr. Agricultural Aid (4-1/2 months)
Ashbel F. Hough, Assoc. Silviculturist

New England States and New York
Victor S. Jensen, Forester
Frank E. Cunningham, Asst. Forester
Benjamin L. Gyure, Asst. Forester (Trans. 8/16/43)
Richard E. Wilson, Asst. Forester (SST 4/20/43)
Donald H. Archer, Jr. Forester (Appt. 12/1/43)

Special Products Supplies Studies
Marinus Westveld, Sr. Silviculturist

Special Historical Studies

Edmond S. Meany, Jr., Agent (Assoc. Information Specialist)
(Military Service 7/28/43)

ALLEGHENY FOREST RESEARCH ADVISORY COUNCIL

1943

Francis R. Cope, Jr., Chairman	Woodbourne Orchards, Dimock, Pa.
Victor A. Beede	Head, Dept. of Forestry, Pennsylvania State College, State College, Pa.
F. W. Besley	303 Wendover Road, Baltimore, Maryland
D. B. Demeritt	Head, Dept. of Forestry, University of Maine, Orono, Maine
E. O. Ehrhart	Forest Engineer, Armstrong Forest Company, Johnsonburg, Pa.
Henry S. Graves	339 Prospect Street, New Haven, Conn.
Austin F. Hawes	State Forester, 165 Capitol Avenue, Hartford 6, Conn.
C. E. Jennings	Curator of Botany, Carnegie Museum, Pittsburgh, Pa.
Joseph F. Kaylor	State Forester, Dept. of State Forests and Parks, State Office Bldg., Annapolis, Md.
Paul Koenig	P. H. Glatfelter Co., Spring Grove, Pa.
Louis Krumenacker	Krumenacker Lumber Co., Carrolltown, Pa.
F. F. Lininger	Director, Agricultural Experiment Station, State College, Pa.
Robert Lyman	President, Gray Chemical Co., Roulette, Pa.
William H. Martin	Director, Agricultural Experiment Station, New Brunswick, New Jersey
H. Gleason Mattoon	Secretary, Pennsylvania Forestry Assoc., Commercial Trust Bldg., Philadelphia 2, Pa.
Stanley Mesavage	Forester, Wyoming Valley Chamber of Commerce, Wilkes-Barre, Pa.
Lawrance W. Rathbun	Forester, Society for Protection of New Hampshire Forests, 9 Capitol Street, Concord, New Hampshire
A. B. Recknagel	Area Forester, Timber Production War Project, Broadway Arcade Bldg., Albany 7, New York
Quentin Reynolds	General Manager, Eastern States Farmers Exchange, West Springfield, Mass.
M. B. Saul	Packard Bldg., Philadelphia 2, Pa.
J. R. Schramm	Head, Dept. of Botany, University of Pennsylvania, Philadelphia 4, Pa.
George L. Schuster	Director, Agricultural Experiment Station, Newark, Delaware
James W. Sewall	Consulting Forester, Old Town, Maine
W. S. Taber	State Forester, Dover, Delaware
Ezra B. Whitman	Engineer, Whitman, Requardt, and Smith, Baltimore, Maryland
C. P. Wilber	State Forester, Dept. of Conservation and Development, Trenton 7, New Jersey
Abel Wolman	Consulting Engineer, Johns Hopkins University, Baltimore 18, Maryland
Hardy L. Shirley, Secretary	Director, Allegheny Forest Experiment Station, Bankers Securities Bldg., Philadelphia 7, Pa.